# HDRI 3D

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ISSUE #4

The Amphibian

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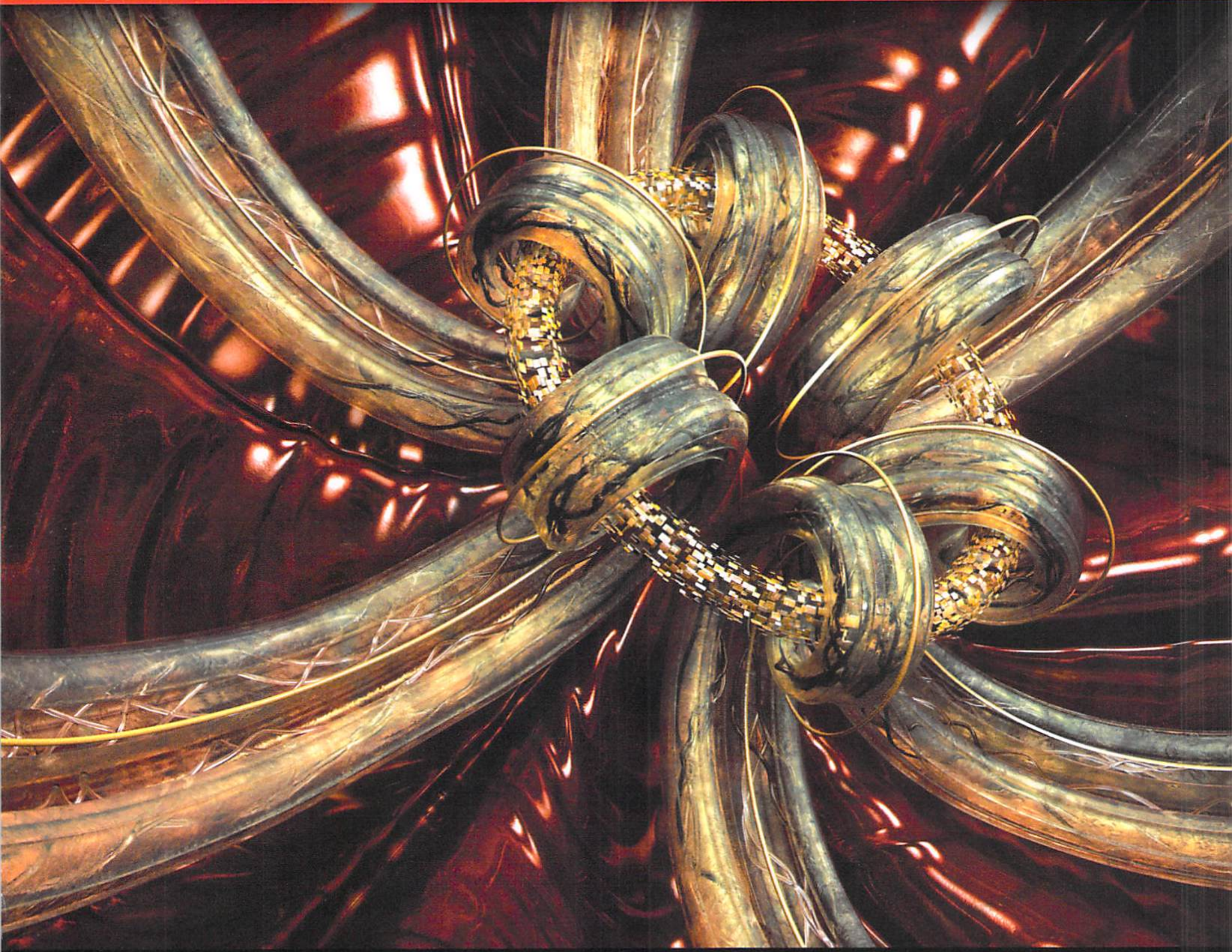

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DAN ABLAN
*EDITOR-IN-CHIEF*

## INFORMATION IS POWER

Many people that I train and deal with on a daily basis still have that excitement about 3D. They find anything in their line of sight and get excited about modeling it. That's great! As I'm reading through the tutorials our awesome contributors have supplied for this issue, I'm actually feeling a bit of that excitement too. It doesn't matter what software application is being used – just seeing a cool technique can spark many ideas!

Recently, I attended a Photoshop conference here in Chicago. It was cheap and close to my office, so I figured "why not." I thought I knew how to use Photoshop, even though there are many areas I rarely touch. To my surprise, I learned quite a bit, and in fact, more than I expected. Something I've said many times before that I have to also remember is; you never stop learning. There is always another approach to something and always more to learn.

With this issue of HDRI 3D, we've put together some exciting tutorials for you. Each one has something for you to learn from, and even if it's using a program that you don't use, read through it and soak it up. And what can you gain from this? Let me put it this way; one of the worst things you could be in life is narrow-minded.

Take this scenario: Imagine your livelihood relies on selling training to people. You're doing this because you've burnt your bridges with studios around town and no one wants to work with you. In order for you to sell your wares, you rely on calling people you don't even know and instead of informing them of how they can learn from your past knowledge, you instead talk poorly about your competition and insult their work. However, people soon realize that not only do you have no talent, but you're a low-class citizen as well. All the talk hides the true fact that you aren't doing the kind of work you wish you were. Deep down, you know it's all true. In the end, all you had to do was be open to new ideas.

Try new things, and remember that you should never stop learning. You have a choice folks – never close any doors.

DARIUSH DERAKHSHANI
*MAYA EDITOR*

## KOOSHLINGS

Recently, I started working on a feature at a studio with a clear majority of LightWave people. At first, until my desk was ready, I sat with the nice LW folks, fearing an attack at any moment from behind. A bat to the skull, a Wacom pen to the neck, mouse cord around the throat from the first second I launched Maya in a room full of LW screens. The pummeling never did come, but I did get into some of the most interesting conversations I've had in a while.

I've been in this for some time, and into computers and software for a while before that. The argument I always catch, overhear, or tumble into is what's better than what. What package runs a better particle sim, which handles character work, but more so than anything else, what should I use for my studio? The thing is, between the time that that question starts and when it ends, things have radically changed in the CG landscape. We've gotten to a point where most packages can handle most tasks well. But the question that people should confront earlier is who and not what.

I remember a long time ago, at an architecture firm far from this world, I helped integrate CAD into their workflow. One afternoon, one of the firm's partners standing over my shoulder and looking at some plans remarked, "Wow, this software does great work." I know what he was really saying with that, but I can't help but feel that people get lost in software. Whenever someone asks me what I recommend, I tell them what I think, but there is always a discussion that follows with more "buts" and "ors" than a canoe and ass party.

But it comes down to this: everyone hates everything they work on, nothing does what it's supposed to, and everyone wants something better. Hell, if I could stomach the implications I would love to hook my cortex up to a Firewire port and just lay down for the day. (No, use USB 2.0!) See what I mean? Applications don't matter.

Clear and simple: with the right people you will get what you need from just about any of the leading packages. And the same goes for computer hardware. If I am witness to another PC v. Mac debate, I will have to bring about The Rapture. Work with what you got. If you are looking to get, get what you can afford and what those who you hire can use. Everything else is really sweating the small stuff. It should be about getting the best work out and not killing yourself or your people over it.

RAFFAEL DICKREUTER
*SOFTIMAGE|XSI EDITOR*

## SOFTIMAGE|XSI HAPPENINGS

If you are working in production, you know how much you can benefit from the skills of your teammates if you run into problems and they can quickly help you out. Usually, all the people within a team have their opinions about the software they are using and have tons of ideas what changes would make that software much better. At the first meeting of the new Los Angeles **SOFTIMAGE**|XSI user group in March, you could meet some of the most skilled **SOFTIMAGE**|XSI users around. Having all these skilled and experienced people from different studios such as Omation, Stan Winston Digital, Pixel Liberation Front, and others discussing production issues in a discussion panel session was certainly a highlight of this user group meeting.

Other presentations were held by Kim Aldis and Bradley Gabe, who presented their thoughts on the challenges faced by large and small studios. By comparing the challenges, it showed, ironically, that larger studios need to find a way to scale down, while smaller shops need to introduce a semblance of linearity to their pipeline.

Andy Jones of Pixel Liberation Front talked about their work on *Sky Captain and the World of Tomorrow.* He explained the use of render passes and a layered production process. Derek Fisher and Matt Young talked about their role in the production, as well. Cloud Painter Matt told a funny story about ironic feedback from the supervisors when he basically used real photographs of clouds and they were seen as "not realistic enough."

After the presentation by **SOFTIMAGE** Special Projects' Michael Isner and Thomas Kang, which included a .ma camera importer and the discussion panels, the guys from Omation Studios talked about the "Barnyard" production process. They amazed the crowd by showing a much extended and newly built Netview that would allow them to add a lot of tools for their artists. Helge Mathee, Jason Barlow, and Graham Clark were present to answer the questions the impressed crowd had, but couldn't reveal more about the production that is still in progress.

**SOFTIMAGE** recently launched a new challenge called "Lock and Load," where aspiring 3D artists can submit mods they created using the free ModTool and win a lot of prizes. Besides that, they also released a new mod exporter for Unreal Tournament on the **SOFTIMAGE** Web site.

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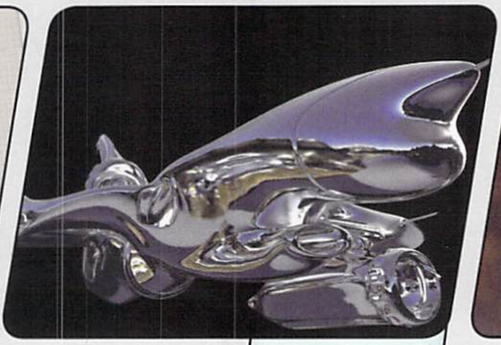

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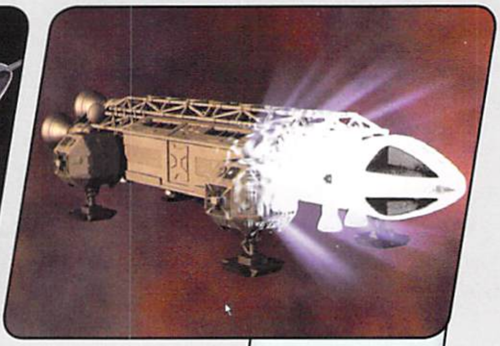

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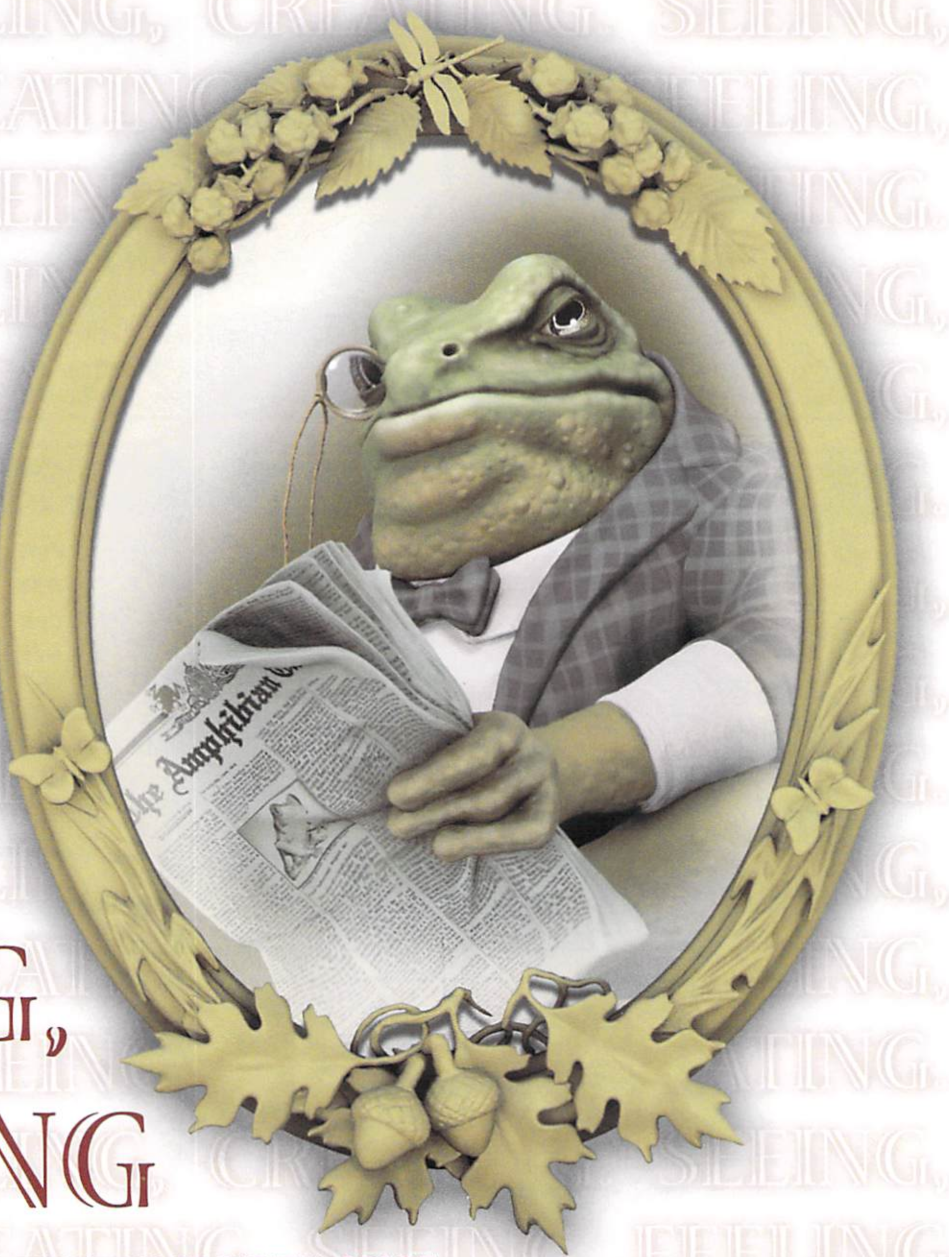


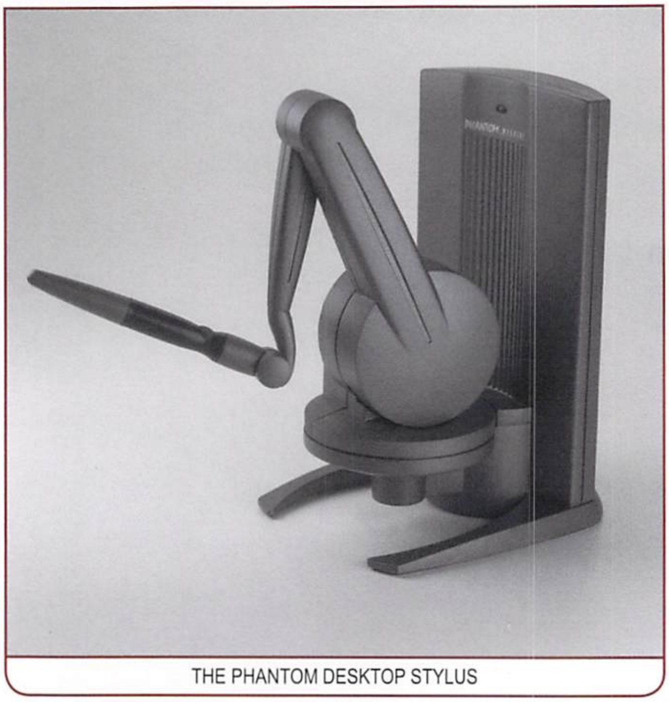
# SEEING, FEELING, CREATING

## THE SCULPTING OF LORD RICHARD RIBBITT IN 3D DIGITAL SPACE

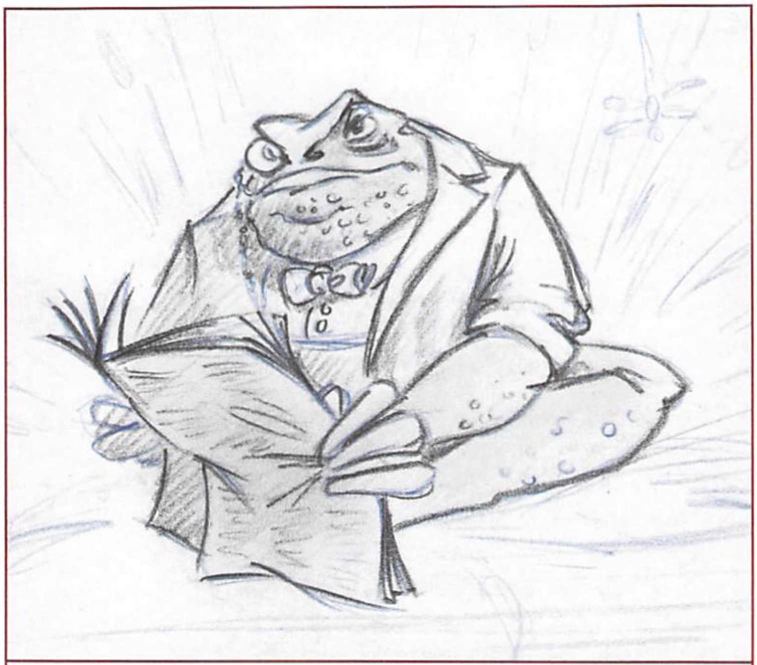
Excerpt from *The Life and Times of Lord Richard Ribbitt:*

Playford River, deep within the heart of the rural Suffolk countryside, is a sleepy little town - and Lord Richard Ribbitt likes it that way. No adventures for him. No strange visitors, no nothing, just the trickle of the Rumble Falls and the rustle of his Amphibian Times™. It's always the same for His Lordship - oh yes, in case you ever have the fortune (or misfortune) to encounter Lord Richard Ribbitt you must remember to refer to him always as "His Lordship," for it is part of Playford legend as to the fate of the first frog to misplace the title in his greeting - the sun rose silently over the serenity of the river as it did yesterday and the day before. The dew dripped from the bushes overhead. The clothed giants with their loud sticks could be heard far beyond the Fairway Fields. More pheasants would be plucked and gutted in the clothed giant's castles this evening.

His Lordship turned from the sound with disgust and lifted the newspaper to his nose again. Squeezing his monocle over his left eye, he returned to the story of the local painter who made his home further down the river. Lucius Lillywhite had apparently grown tired of painting the same fields, the same, bushes, and the same riverbank. He wanted it known that he intended to leave the river in search of brave new inspiration. He was to embark on an adventure. His Lordship looked up from the newspaper...



THE PHANTOM DESKTOP STYLUS



PRELIMINARY SKETCH AND REFERENCE MATERIAL ARE PREPARED BEFORE SCULPTING

In this tutorial, I will explain how the FreeForm® Modeling Plus™ system was responsible for breathing life into His Lordship.

The usage of the FreeForm® Modeling Plus™ system is revolutionizing the way we sculpt. The utilization of the PHANTOM® Desktop device, essentially a modeling knife in digital space, allows the user to miraculously feel the cyber clay he or she is sculpting, giving the artist the freedom of reality within the digital language.

Upon start-up of the FreeForm Modeling Plus system, the artist will notice a large block of buff colored clay in the middle of the window. The clay can be moved using a mouse, keyboard keys, or the PHANTOM Desktop device. To use the mouse it's a simple left-click over the clay to rotate it, a right-click to zoom it, and a middle-click to pan it. Keyboard users can employ their faithful arrow keys for the same functions and those with one foot in the 22nd Century can show off with the PHANTOM Desktop device, the method of choice for most FreeForm Modeling Plus users. To grab the block of clay, a function ingeniously called "grabbing," press and hold down the "g" key on the keyboard and move the PHANTOM Desktop's stylus in any direction to move and tumble the view.

The PHANTOM allows a full six degrees of freedom in movement (in and out, up and down, left and right, pitch, roll, and yaw), and three degrees of force feedback (in and out, up and down, and left and right).

The PHANTOM Desktop device can also be used as a mouse within the FreeForm Modeling Plus system. With the selection of the Carve with Ball tool, for example, when the stylus is held by the artist (as you would a pen) over the clay, the cursor remains a tool. When the stylus is held over any menu feature, it becomes a recognizable cursor. This simple device offers all the functions of the mouse and keyboard in one easy-to-use instrument.

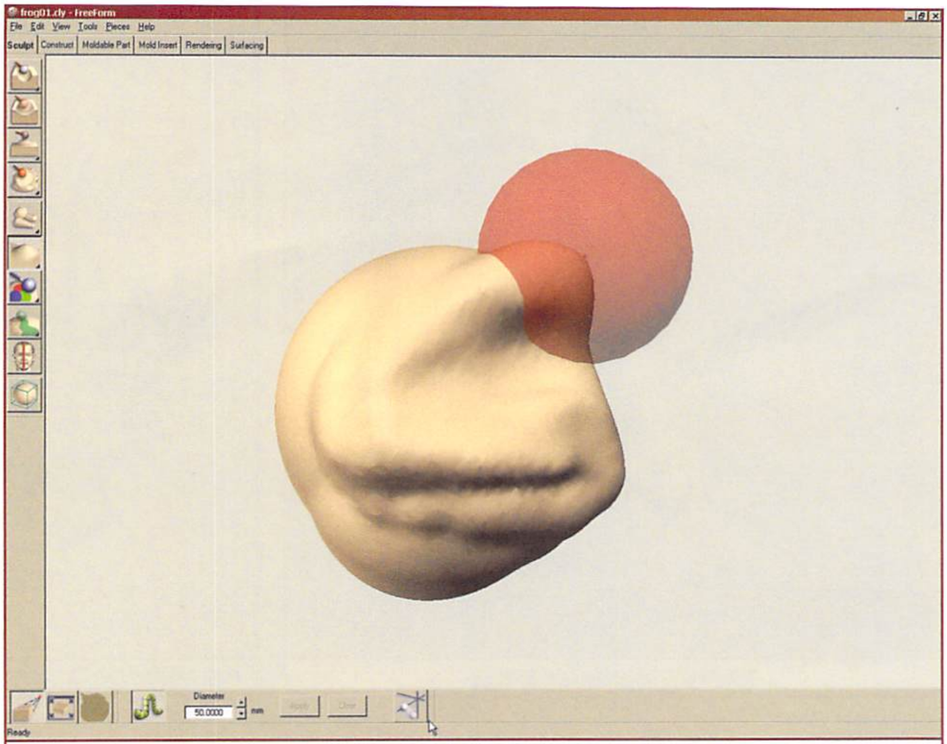
There are a plethora of tools available within the FreeForm Modeling Plus system, but for the sake of this tutorial, only the tools used to create this character will be discussed at length. These are the Carve with Ball tool, Smooth tool, Tug tool, and Smudge tool. It can be said that there are no words adequate enough to communicate the sensation of working within this system, of designing and building with the PHANTOM Desktop device and of feeling every inch of clay without getting your hands dirty. It can also be said that working within 3D digital space will take some time to master, but practice makes perfect, and within the FreeForm Modeling Plus system, perfection will become a standard.

And so to the characters of Playford River and Lord Richard Ribbitt, master of all he surveys. His Lordship is essentially created in a number of separate pieces. This allows a great freedom in later stages with individual positioning and offers an almost limitless freedom in the relationship between neck and chin, arm and hand, hand and newspaper.

Prior to the commencement of sculpting, research is carried out to build a library of reference material relating to the figure to be sculpted. In this case, a considerable amount of photographic reference is accumulated to help understand the external biology of Great Britain's common frog.

## STAGE ONE – *IT'S ALL IN YOUR HEAD:*

Using a combination of keyboard shortcuts and the PHANTOM Desktop device, the selection of the Tug tool locks the digital sculpting knife onto the block or sphere of clay like a spoon on treacle and gives the artist the effect of pulling and pushing on a very strong elastic band. Releasing the clay at any given point will leave it at the desired position for the shape of the sculpture. In the case of His Lordship, a sphere of clay is used to mold his aggressive glare. Other tools come into play now: Carve with Ball (to sculpt into the clay with a hard edged tool) and Smudge (to smooth the clay with less abrasive angles). The basic look of His Lordship is established in these initial movements, on one side of the clay only, with pulling and pushing working in unison to develop his wide mouth and crumpled eyelids. His Lordship's eyes will be created as separate images to be combined with the finished head during the final stages. Once the work on this side is complete, albeit in a crude form, the entire sculpture is duplicated for the other side by selecting Mirror Entire Image, to complete the symmetrical amphibian head. The mirror may appear in the workspace exactly where needed, but if not, can simply be moved by use of the Positioning Aids on the Dynabar (a combination of the words Dynamic and Toolbar) at the base of the workspace. This is a highly convenient feature of the Freeform Modeling Plus system and greatly reduces sculpt time, significantly lightening the demands on the artist.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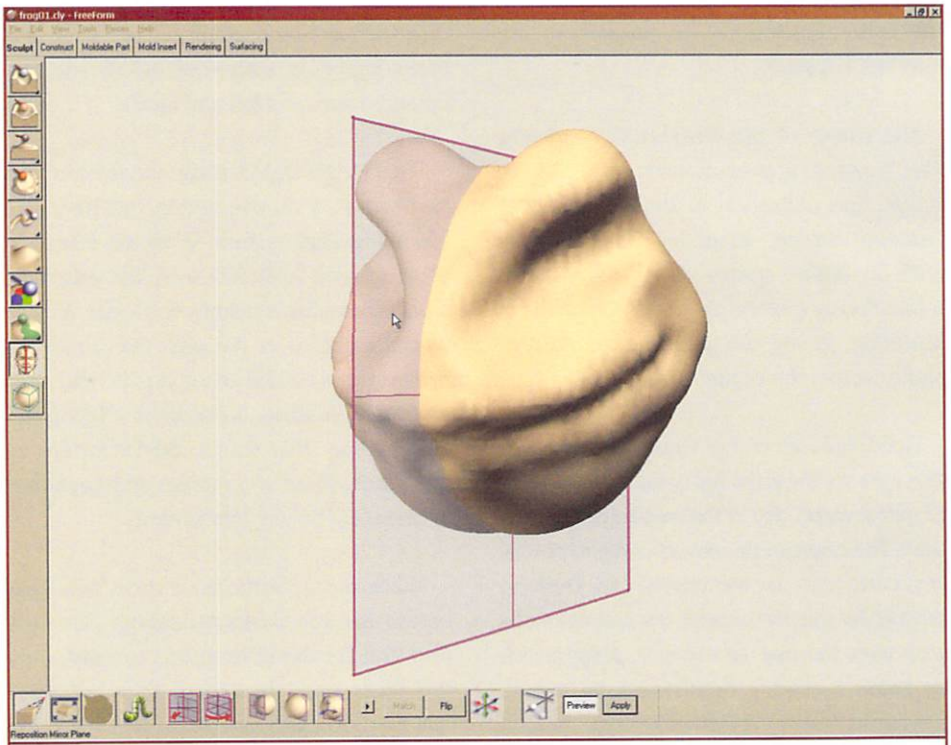
USING THE TUG TOOL TO SCULPT AND SHAPE THE HEAD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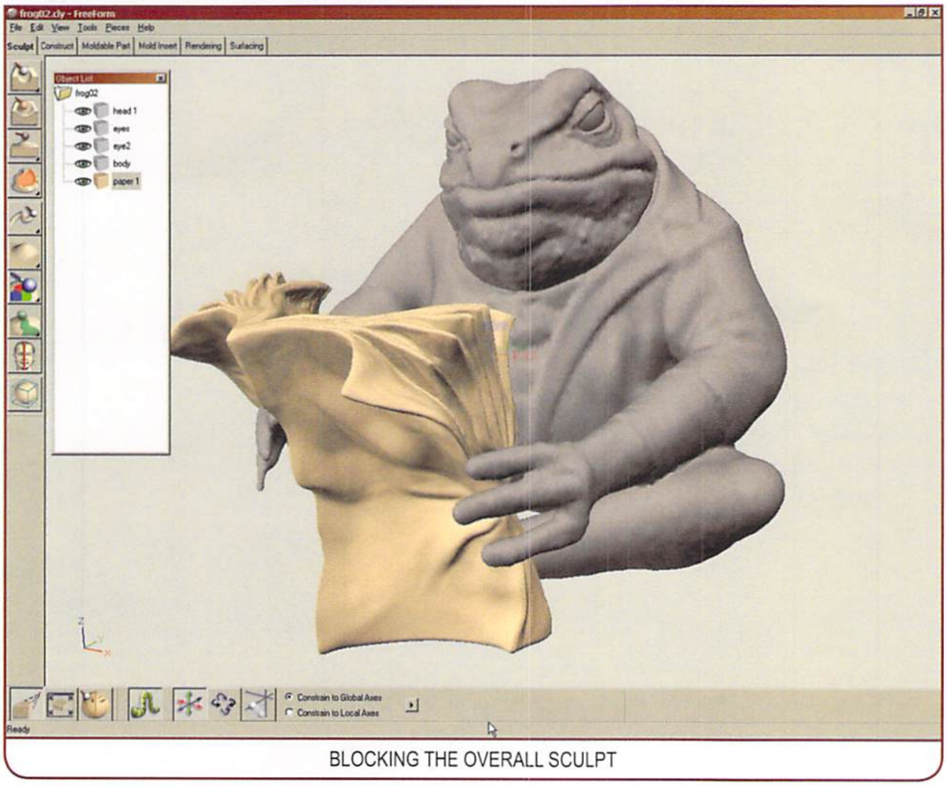
Match
Flip
Preview
Apply
Reposition Mirror Plane

USING THE MIRROR TO DUPLICATE ONE SIDE ONTO THE OTHER

## STAGE TWO – *SO MANY APPENDAGES:*

A new piece in the Object List and a larger sphere of clay are selected for His Lordship's ever increasing torso, which consists of his shirt collar and jacket molded over the bulk of his chest. The eyes, bowtie, legs, hands, newspaper, and monocle are, as the torso, all individual elements to be combined later. The size and tightness of the shirt collar and jacket must be considered in the careful relationship between His Lordship's head and separate body elements. These dimensions, although not measured with pinpoint accuracy, must be designed to sit comfortably under the chin to create the lived-in appearance of His Lordship's clothing.

Once again, a new piece is selected from the Object List and the sculpting of His Lordship's left arm begins. This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Ready

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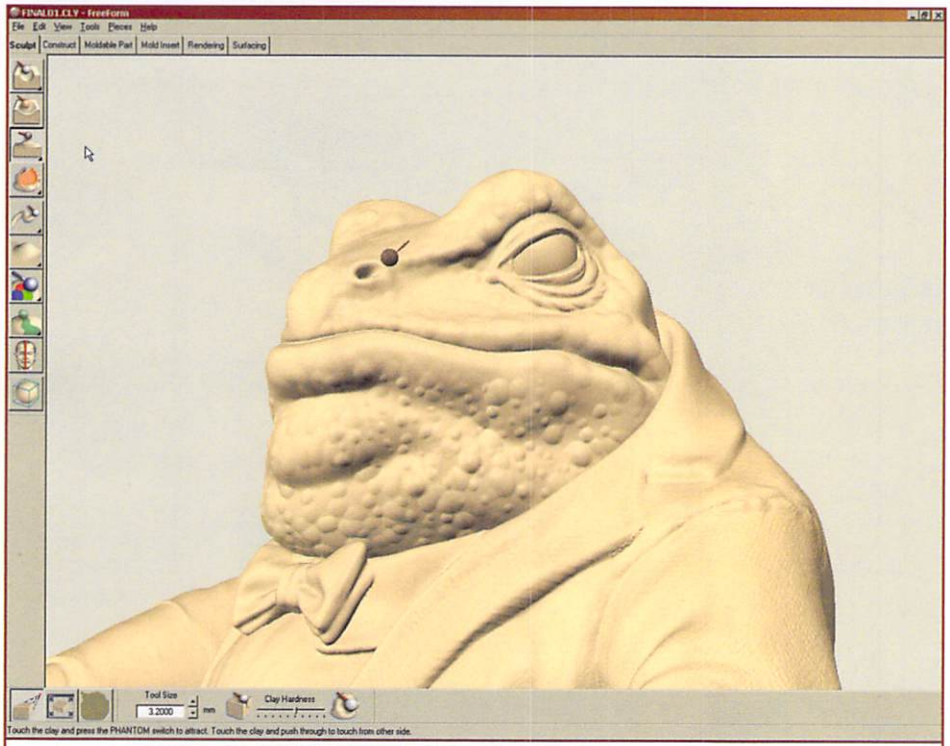
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Clay Hardness

Touch the clay and press the PHANTOM switch to attract. Touch the clay and push through to touch from other side.

CLAY COARSENESS IS REFINED ENABLING THE ADDITION OF GREATER DETAIL

procedure is identical in terms of tools used and is repeated for the remaining elements: the hand, bowtie, monocle, string, and newspaper.

As an addendum to this stage, it should be noted that in the case of the newspaper, the item could be sculpted using the Construction menu, which would allow measurements to be calculated with the aforementioned pinpoint accuracy. This intelligent feature will probably become invaluable in the construction/engineering business, but for the sake of emulating an organic environment for His Lordship, *The Amphibian Times* is simply sculpted using the traditional tools.

## STAGE THREE – *IT'S ALL IN THE DETAILS:*

Once initial blocking of His Lordship is complete, it's time to look deeper and begin to add the finer details: warts (don't tell His Lordship we refer to them as warts), wrinkles and folds in the flesh, nostrils, and rings around the eyes. The Attract tool is the best way to accomplish the bulk of this stage, and its usage couldn't be easier. Select the Attract tool and, while holding down the stylus button, run the tool across the area of the face that needs to be detailed. The clay pulls toward the tool and shaping becomes a matter of how far the clay is pulled. However much His Lordship likes to believe he's a complicated individual, he really is that simple.

This stage also encompasses the texturing for the jacket. A series of curved lines are drawn over the contours of His Lordship's jacket to tell the program exactly where the texture (embossed image) must adhere. In the Construct menu, Draw is selected and acts as a simple pencil, allowing curves to be applied onto the surface of the clay.

Attention then turns to Special Effects found under Tools, and selecting Emboss with Image brings up a Dynabar at the bottom of the workspace. A thumbnail image of the texture to be used will appear in the Dynabar. To change the image (jpeg/bitmap), simply click the thumbnail and choose from any image directory. Activating the curves on the clay will emboss the image and once applied, scale, distance, and direction can be manipulated by use of the stylus and stylus button (emboss.tiff). The texture adheres to each individual fold and ripple and His Lordship now has a fully fleshed out jacket. Mention should also be made to the painting of His Lordship: if you have ever used a paint program before, you know how to paint in the FreeForm Modeling Plus system.

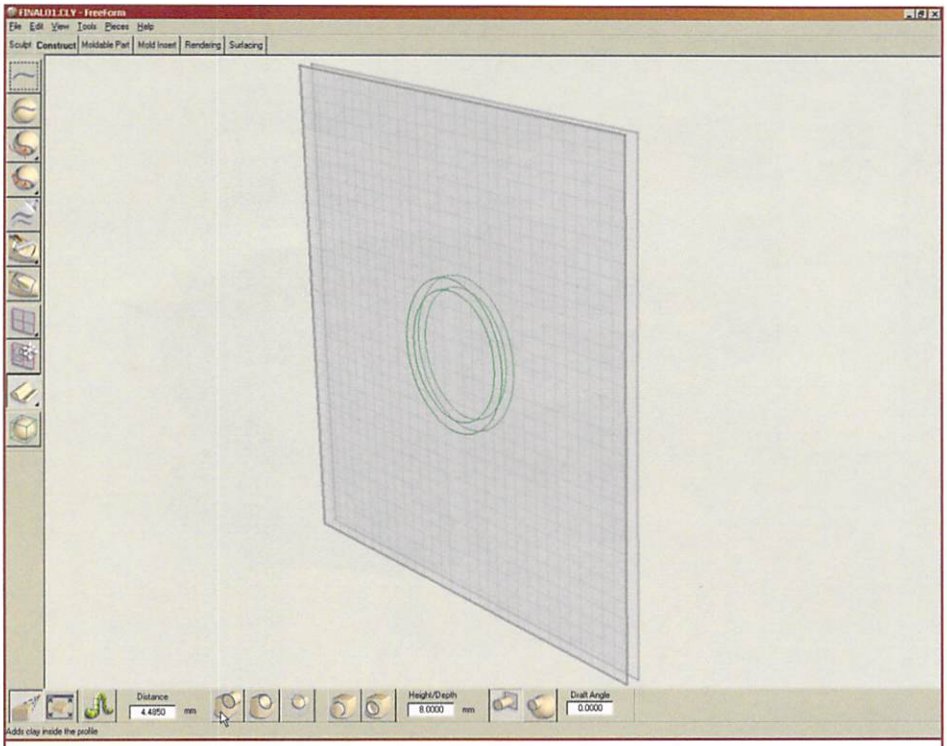
## STAGE FOUR – *MONOCLE, MY MONOCLE:*

Essentially, a stage that can be completed at any point during the sculpting process due to the limitless resizing options in FreeForm Modeling Plus, the creation of His Lordship's monocle nevertheless, feels like the finishing touch.

From the Construct tab, the Construct Environment is selected. This has its own menu from which the New Plane/Sketch icon is selected. The monocle is easily crafted using two planes. From the Construct Environment, a New Plane is selected, and then with the Circular Line tool, a single click on the plane affixes the cursor. Still using the stylus, the cursor is pulled out from the center as far as desired to create a circle. The procedure is repeated to form a rim, a thick circle between the two lines. With the monocle circles formed, the time for a Wire Cut is just around the corner. His Lordship is consulted at this point for his approval and distracting though he is, the tutorial is over halfway through, so the best thing to do is simply ignore him.

So, once the planes are the desired distance apart, Create Inside is selected on the Wire Cut Dynabar; the FreeForm Modeling Plus system then creates the circle of clay and the planes disappear.

The same procedure is followed for the creation of the frame with the leaves and happy little Dragonfly, sculpted with the Freehand Curve tool on the Sketch Toolbar. The leaves and twigs are also duplicated using the basic copy and paste procedure familiar to all PC users.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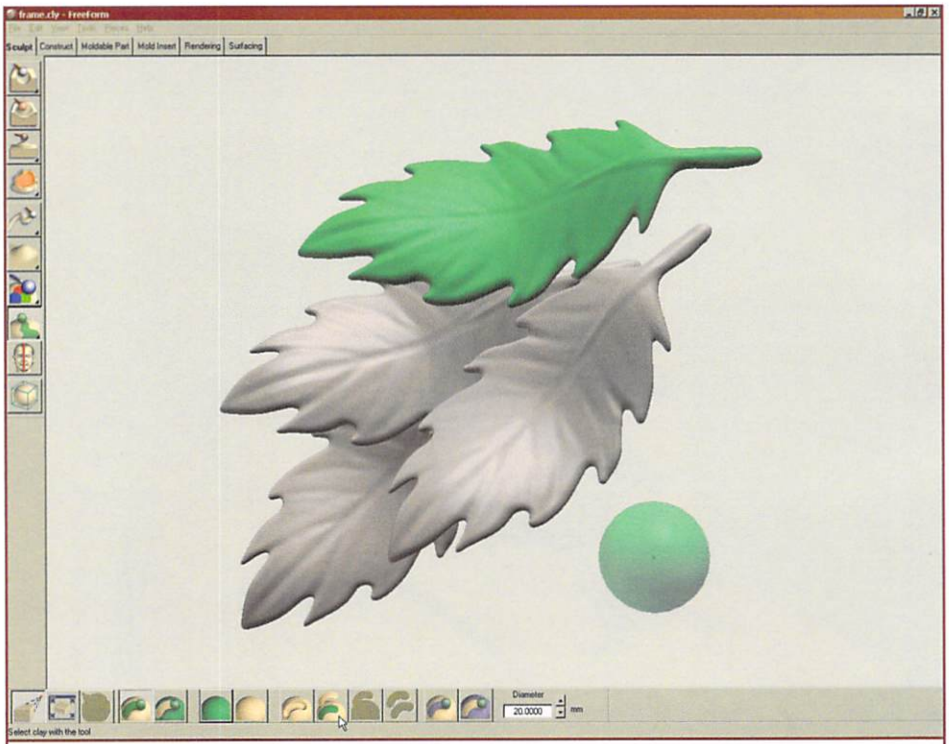
Distance 4.4850 mm
Height/Depth 8.0000 mm
Draft Angle 0.0000

Adds clay inside the profile

PLANES USED TO DRAW WIRE CUTS AND CREATE SIMPLE OR COMPLEX GEOMETRIC SHAPES LIKE THE MONOCLE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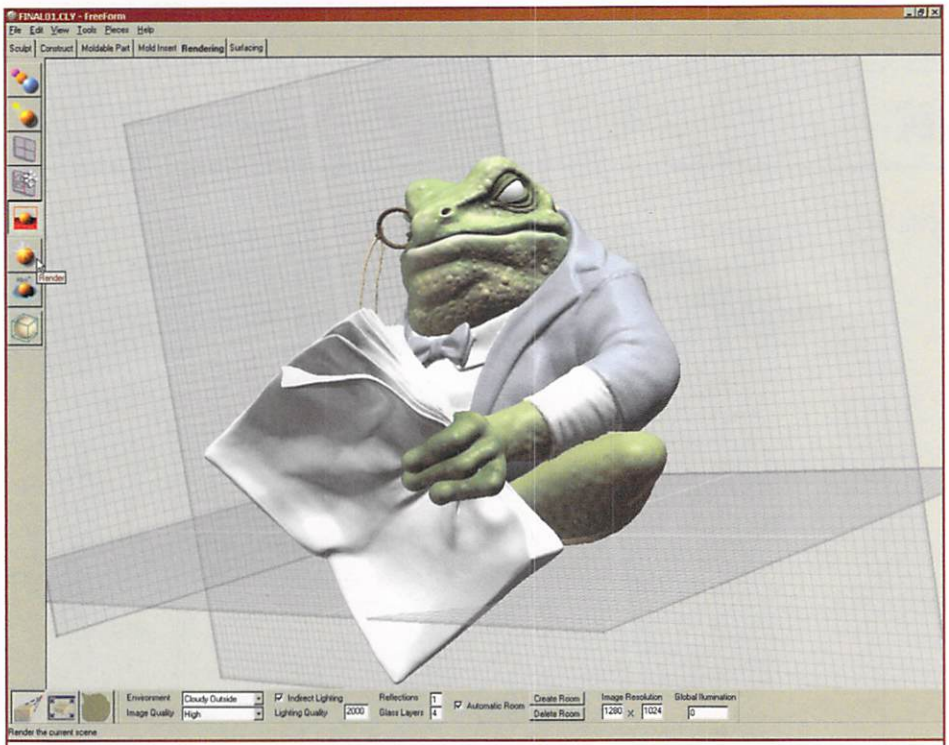
Diameter 20.0000 mm

Select clay with the tool

PIECES CAN BE SELECTED, COPIED, AND PASTED AS NEW PIECES LIKE THIS LEAF

## STAGE FIVE – *MANY POSITIONS:*

His Lordship is now ready to be combined. This is the part he dislikes the most – apparently it tickles. Each individual piece is listed in the Object List: head, torso, arm, hand, etc., and by clicking on an item, the piece can be moved (within obvious amphibian limitations) to any space on the model. This is where knowledge of anatomy is most helpful, for example, in understanding the relationship between amphibian limbs and their correlation to each other in the more human form of His Lordship. How high should his collar sit?


FINAL01.CLY - FreeForm
File Edit View Tools Pieces Help
Sculpt Construct Moldable Part Mold Insert Rendering Surfacing
Render
Create Room
Delete Room
Render the current scene

Environment: Cloudy Outside
Image Quality: High
☑ Indirect Lighting
Lighting Quality: 2000
Reflections: 1
Glass Layers: 4
☑ Automatic Room
Image Resolution: 1280 × 1024
Global Illumination: 0

HIS LORDSHIP IS POSITIONED AFTER LIGHTING, RENDERING PLANES, AND MATERIAL PROPERTIES HAVE BEEN SET

How close should his arm be to his torso? How big should his hand be in relation to his arm? All these factors are carefully considered in this final construct to give the best, most organic representation to His Lordship.

### STAGE SIX – *I'M READY FOR MY CLOSE-UP:*

Now that His Lordship is successfully sculpted and a frame worthy of his regal features is complete, the rendering can begin. Figure and frame are rendered separately to achieve the right juxtaposition; lighting for His Lordship will appear quite natural while lighting for the frame will imitate an enclosed environment. In the Rendering menu, lights are positioned and created and Rendering Planes selected using the stylus. Because His Lordship was created in pieces, specific material properties can be applied to each separate piece. When selecting the "head" from the Object List and the material properties on the Rendering menu, the Dynabar displays an array of options: readymade material properties such as glass, gold, and rubber, as well as the option to customize specific material by using the sliders to represent shine, gloss, reflection, and translucence. Color can also be applied, although His Lordship's head has already been painted so only slight shine and gloss is given to imitate his wet skin – of which, by the way, he is very proud. A matte, opaque quality is maintained for *The Amphibian Times* and His Lordship's clothing, and for the monocle, the readymade material "bronze" is chosen.

The entire workspace is essentially a camera lens, so His Lordship is positioned accordingly. The rendering planes are positioned close to the subject and enlarged for sufficient surface area to reflect enough light. Once satisfied with the lighting, material properties, position of the rendering planes, and subject, the quality of the render is defined. Selecting the Render Properties tab, the Dynabar offers three quality settings: Low, Medium, and High. The default is a fast test render with the quality set to Low, Light Quality 100, and Pixel Ratio 320x480. For this particular render (and being careful not to upset His Lordship), the overall quality is set to High, Light Quality 2000, and Pixel Ratio 1280x1024. Depending on PC spec, some higher settings may demand a very long wait, so beware His Lordship's patience and short temper.

When rendering is complete on His Lordship and the frame, both are saved as Bitmap Images and imported into the photo edit program of choice. Little needs to be done in this stage and it's safe to say this touch-up is all based on personal preference.

### LAST WORDS – *LEAPFROG TO THE FUTURE:*

Lord Richard Ribbitt, now immortalized within the digital realm can, at any point, be physically reproduced within the real world of Rapid Prototyping. This is where His Lordship will feel the enormous possibilities the FreeForm Modeling Plus system can afford him and those like him.

For this sculpture, a Dell Workstation running Windows2000 Pro was used. Dual Pentium 4 2GHz processor, Nvidia Quadro 4 750XGL graphics card, 2GB RAM.

The recommended minimum is: Intel Pentium single 2.0 GHz or dual 1.0 GHz; 1 GB RAM; Windows2000 SP3 or Windows XP Professional SP2; an EPP or ECP compatible parallel port; a qualified graphics card (a list of cards can be viewed at SensAble's Web site: www.sensable.com).

Sculpture by Simon A. Goodall
simon@goodallarts.com

**SIMON GOODALL** WAS BORN IN IPSWICH, SUFFOLK, ENGLAND IN 1975. SINCE CHILDHOOD, HE HAS HAD A FASCINATION WITH ALL THINGS FANTASTICAL. HE HAS BEEN WORKING AS A SELF-EMPLOYED 'DIGITAL SCULPTOR' FOR NEARLY FIVE YEARS, AND HAS WORKED PREDOMINANTLY WITH SENSABLE'S FREEFORM MODELING PLUS SYSTEM SINCE 1999. BEFORE ADVANCING HIS CAREER WITH COMPUTERS, HE HAD STUDIED AS A FINE ARTIST AND SCULPTOR AT THE UNIVERSITY OF HERTFORDSHIRE. UPON LEAVING ACADEMIC STUDIES, HE FELL INTO A JOB MODELING TOYS FOR POPULAR LICENSED BRANDS SUCH AS DISNEY AND HASBRO. OTHER CURRENT WORK INCLUDES CONCEPTUAL DESIGN ILLUSTRATION AND STORYBOARDING FOR TELEVISION. SIMON ALSO ENJOY PAINTING.

BY ANDREA CARVEY

# LINKING OBJECTS TO PARTICLES

## PART 2 - FX LINK

In the last issue, I examined FX Linker and used it to clone an object (in that case, either an apple or banana) and shoot a bunch of clones into the air. Hopefully, you were able to duplicate my efforts without too much difficulty. As promised, FX Link will be explored in this issue. I will also provide a brief chart comparing the two similarly named effects.

I will be using the same scene setup as with the FX Linker article so that it will be easier to distinguish the difference between the two effects.

Basically, you set up a particle emitter and then "link" an object to the motion of one of the particles. The difference between FX Link and FX Linker is that FX Link creates a link between an individual object and a particle. As always, there are pros and cons for each of the tools, and which one you use will depend on what you need to do.

### SET UP THE HV EMITTER

BEGIN WITH CLEARED SCENE
ADD HV EMITTER

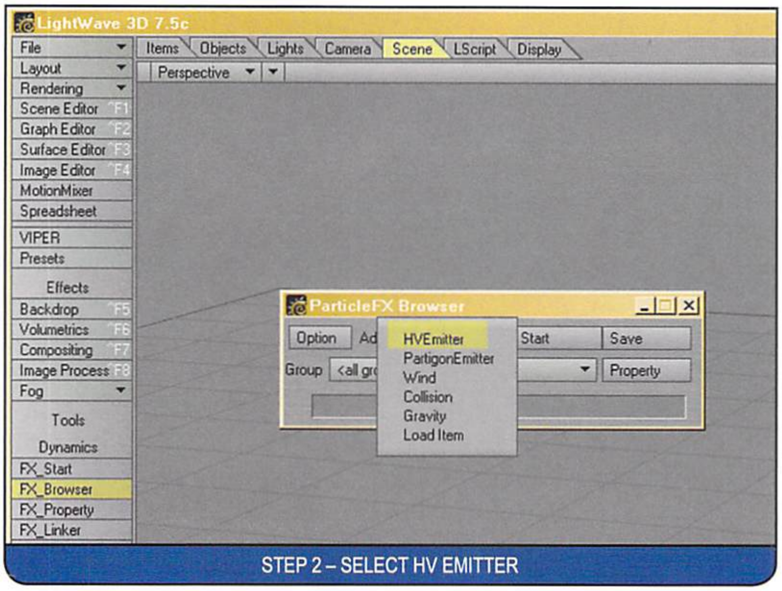
1. Open the ParticleFX Browser - Scene / FX_Browser (in the Tools/Dynamic section)

2. Select "HV Emitter" from the "Add" drop-down menu (It must be clicked twice, once to access the dropdown menu, another time to select the HV Emitter.)

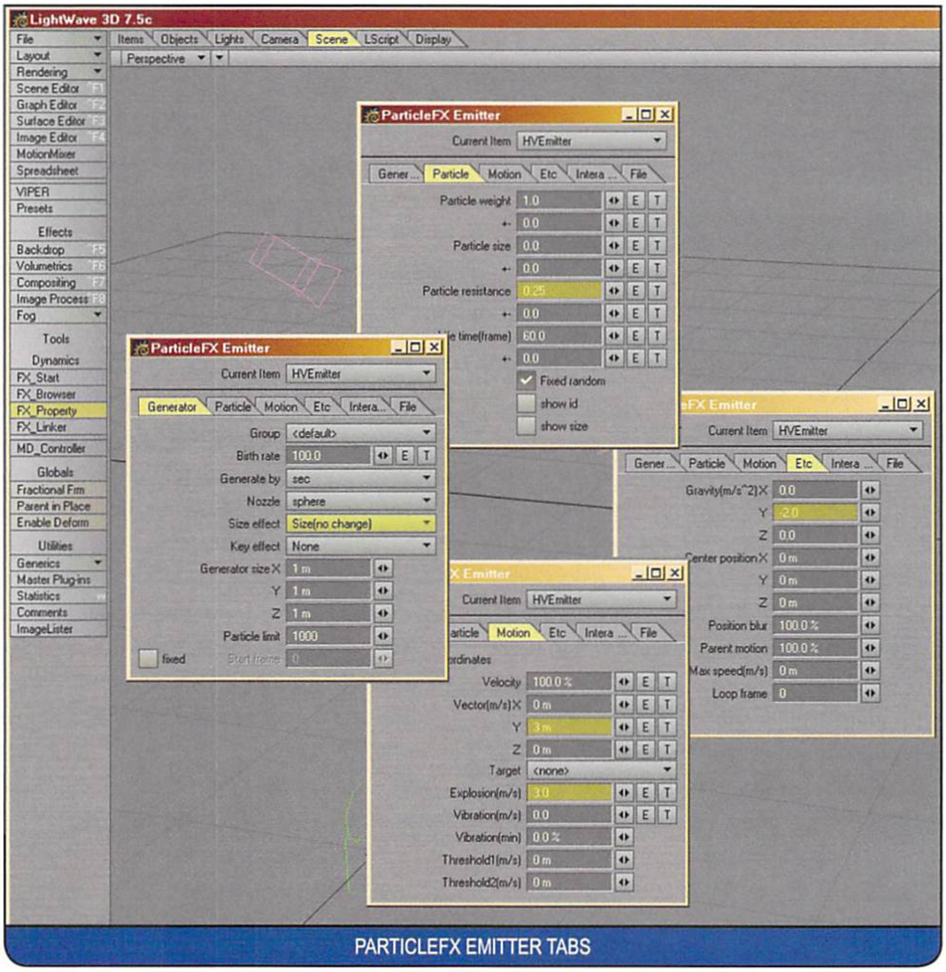
3. Close the ParticleFX Browser

### A NOTE ABOUT STEP 2

Either the HV Emitter or the Partigon Emitter will work, but Partigons that are not assigned to an object will render as tiny sparks, whereas particles from the HV Emitter will not be visible. If you want the sparks, no problem, but by changing the Surface Transparency of the Partigon Emitter to 100%, they become invisible.


LightWave 3D 7.5c
File
Layout
Rendering
Scene Editor
Graph Editor
Surface Editor
Image Editor
MotionMixer
Spreadsheet
VIPER
Presets
Effects
Backdrop
Volumetrics
Compositing
Image Process
Fog
Tools
Dynamics
FX_Start
FX_Browser
FX_Property
FX_Linker
Items
Objects
Lights
Camera
Scene
LScript
Display
Perspective
ParticleFX Browser
Option
Ad
Group
<all gr
Start
Save
Property
HVEmitter
PartigonEmitter
Wind
Collision
Gravity
Load Item

STEP 2 – SELECT HV EMITTER


LightWave 3D 7.5c
File
Layout
Rendering
Scene Editor
Graph Editor
Surface Editor
Image Editor
MotionMixer
Spreadsheet
VIPER
Presets
Effects
Backdrop
Volumetrics
Compositing
Image Process
Fog
Tools
Dynamics
FX_Start
FX_Browser
FX_Property
FX_Linker
MD_Controller
Globals
Fractional Frm
Parent in Place
Enable Deform
Utilities
Generics
Master Plug-ins
Statistics
Comments
ImageLister
Items
Objects
Lights
Camera
Scene
LScript
Display
Perspective
ParticleFX Emitter
Generator
Particle
Motion
Etc
Intera...
File

Current Item HVEmitter

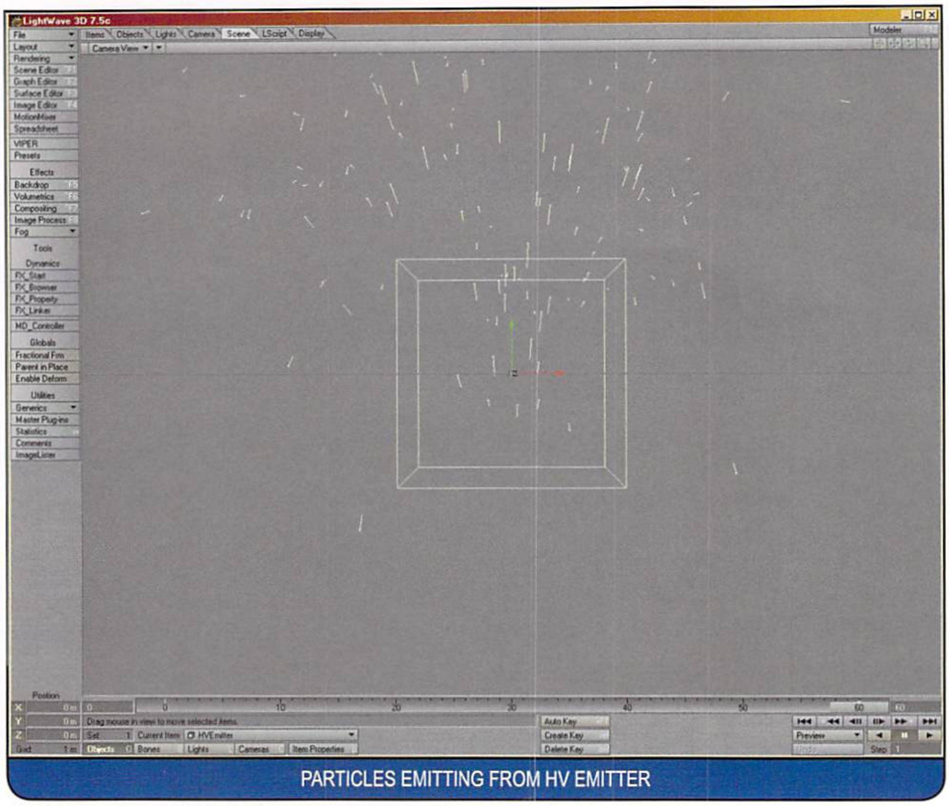
Generator tab:
Group <default>
Birth rate 100.0
Generate by sec
Nozzle sphere
Size effect Size(no change)
Key effect None
Generator size X 1 m
Y 1 m
Z 1 m
Particle limit 1000
☐ fixed
Start frame 0

Particle tab:
Particle weight 1.0
+- 0.0
Particle size 0.0
+- 0.0
Particle resistance 0.25
+- 0.0
Life time(frame) 60.0
+- 0.0
☑ Fixed random
☐ show id
☐ show size

Motion tab:
Velocity 100.0 %
Vector(m/s) X 0 m
Y 3 m
Z 0 m
Target <none>
Explosion(m/s) 3.0
Vibration(m/s) 0.0
Vibration(min) 0.0 %
Threshold1(m/s) 0 m
Threshold2(m/s) 0 m

Etc tab:
Gravity(m/s^2) X 0.0
Y -2.0
Z 0.0
Center position X 0 m
Y 0 m
Z 0 m
Position blur 100.0 %
Parent motion 100.0 %
Max speed(m/s) 0 m
Loop frame 0

PARTICLEFX EMITTER TABS


LightWave 3D 7.5c

PARTICLES EMITTING FROM HV EMITTER

## CREATE PARTICLE MOTION

4. Select the HV Emitter

5. Open the "ParticleFX Emitter" window
- Scene / FX Property

6. Change the following default settings:
Generator Tab– **Size Effect** = **Size (no change)**
Particle Tab– Resistance = **.25**
Motion Tab– Vector (m/s) y = **3 m**
– Explosion (m/s) = **3.0**
Etc. Tab– Gravity (m/s2) y = **-2.0**

7. Close the "ParticleFX Emitter" window.

When you run the animation, particles should emit over 60 frames.

### NOTES ABOUT STEP 6

**GENERATOR TAB**

One weird quirk occurs occasionally. If one of the other "Size Effect" parameters is selected, (sometimes) only one particle seems to be emitted, which makes it seem like nothing is happening.

**PARTICLE TAB**

Under the Particle Tab of the ParticleFX Emitter window, there is a parameter called "Particle Lifetime." This determines how long (in frames) a particle "lives" or is visible and moves. To prevent the object that is linked to a particle from stopping in mid-air, make sure that the Particle Lifetime is equal to or longer than the animation.

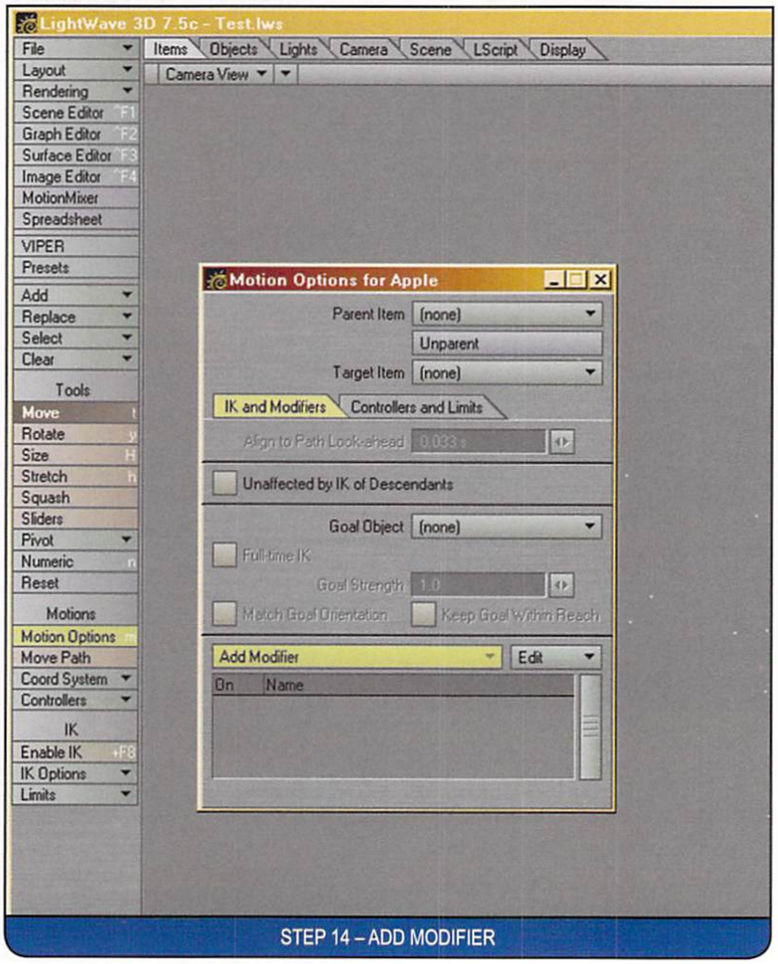
## SET UP THE SCENE

8. Load Object
Use Lightwave /Objects /Food /Apple (or Banana, or whatever).

9. Move Camera
Suggestion: y = **1.25 m**; z = - **5m**
(Create keyframe at frame "0").

10. Size HV Emitter
Select HV Emitter.
Change "Scale" - Suggestion x, y, z, = .1 (Items / Size). (Create keyframe at frame "0".)

11. Save Scene (This is not crucial, as it is with FX Linker. With FX Link, it is easy to link and unlink objects without having to recreate or reload the scene.)


LightWave 3D 7.5c - Test.lws
File
Layout
Rendering
Scene Editor
Graph Editor
Surface Editor
Image Editor
MotionMixer
Spreadsheet
VIPER
Presets
Add
Replace
Select
Clear
Tools
Move
Rotate
Size
Stretch
Squash
Sliders
Pivot
Numeric
Reset
Motions
Motion Options
Move Path
Coord System
Controllers
IK
Enable IK
IK Options
Limits
Items
Objects
Lights
Camera
Scene
LScript
Display
Camera View
Motion Options for Apple
Unparent
IK and Modifiers
Controllers and Limits
Add Modifier
Edit
On
Name

Parent Item (none)
Target Item (none)
Align to Path Look-ahead 0.033 s
☐ Unaffected by IK of Descendants
Goal Object (none)
☐ Full-time IK
Goal Strength 1.0
☐ Match Goal Orientation ☐ Keep Goal Within Reach

STEP 14 – ADD MODIFIER

## LINK PARTICLES TO OBJECTS

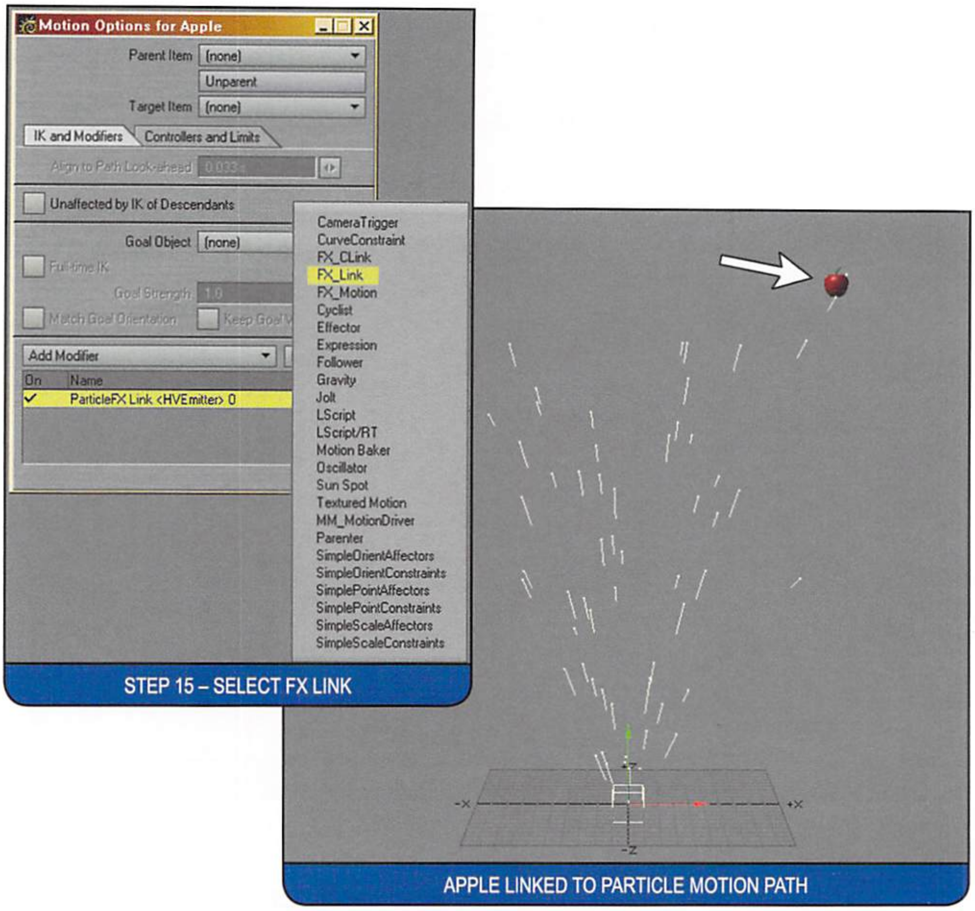
12. Select Object (apple or banana)

*(Now, here's where things get different.)*

13. Open the Motion Options window (Items/Motion section).

14. Click "Add Modifier" in the IK and Modifiers Tab *(See figure previous page).*

15. Select "FX_Link" from the drop down menu. (The text "ParticleFXLink<HVEmitter>0" is added to the Modifier window and the object is now linked to one of the particles. The number indicates which particle the object is linked to, in this case, particle number "0".)


Motion Options for Apple
Parent Item
Unparent
Target Item
IK and Modifiers
Controllers and Limits
Align to Path Look-ahead
Unaffected by IK of Descendants
Goal Object
Full-time IK
Goal Strength
Match Goal Orientation
Keep Goal W
Add Modifier
On
Name
CameraTrigger
CurveConstraint
FX_CLink
FX_Link
FX_Motion
Cyclist
Effector
Expression
Follower
Gravity
Jolt
LScript
LScript/RT
Motion Baker
Oscillator
Sun Spot
Textured Motion
MM_MotionDriver
Parenter
SimpleOrientAffectors
SimpleOrientConstraints
SimplePointAffectors
SimplePointConstraints
SimpleScaleAffectors
SimpleScaleConstraints
-X
+X
-Z

Parent Item (none)
Target Item (none)
Goal Object (none)
✓ ParticleFX Link <HVEmitter> 0

STEP 15 – SELECT FX LINK

APPLE LINKED TO PARTICLE MOTION PATH

Run the animation, and you should see the apple (or banana) fly up into the air all by itself (well, along with a bunch of particles, but not with a bunch of apple clones). Yowsa!

Now, here's the neat part. Suppose that one of the particles has a particularly interesting trajectory and you want the banana linked to *that* particle. No problem!

## SPECIFY LINKED PARTICLE

16. Select HV Emitter.

17. Activate "show id" option (Scene/FX Property/Particle Tab). Now when you run the animation, each particle is identified by a number.

18. Decide which particle you want the object linked to.

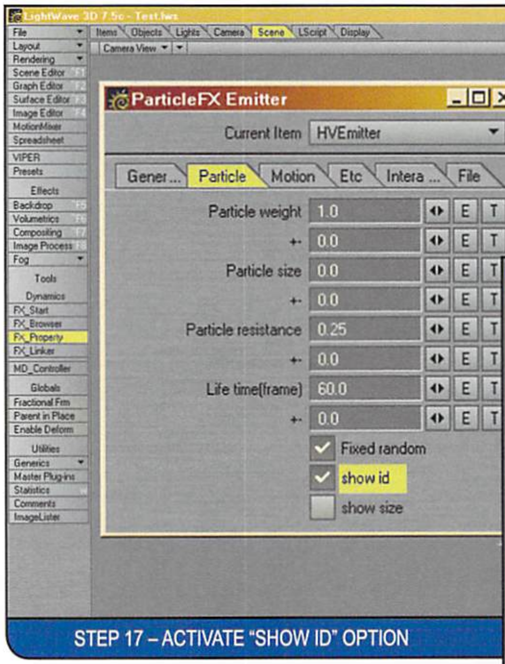
19. Select the Object.

20. Open the Particle FX LINK window. (Items/Motion Options/ IK and Modifiers Tab, and double-click on the text in the Modifier field - "ParticleFXLink<HVEmitter>0".

21. Enter the particle number in the "Node" field.

22. Click "OK".

When you run the animation now, the object is linked to the particle that you designated.


LightWave 3D 7.5c - Test.lws
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FX_Linker
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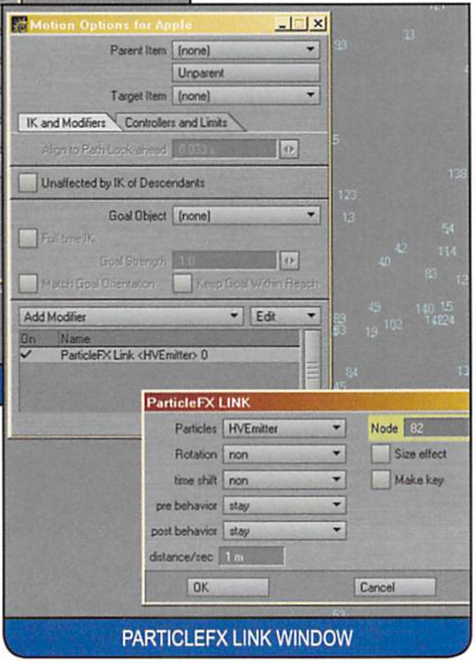
Globals
Fractional Frm
Parent in Place
Enable Deform
Utilities
Generics
Master Plug-ins
Statistics
Comments
ImageLister
Items
Objects
Lights
Camera
Scene
LScript
Display
Camera View
ParticleFX Emitter
Gener...
Particle
Motion
Etc
Intera...
File
E
T

Current Item HVEmitter
Particle weight 1.0
+- 0.0
Particle size 0.0
+- 0.0
Particle resistance 0.25
+- 0.0
Life time(frame) 60.0
+- 0.0
☑ Fixed random
☑ show id
☐ show size

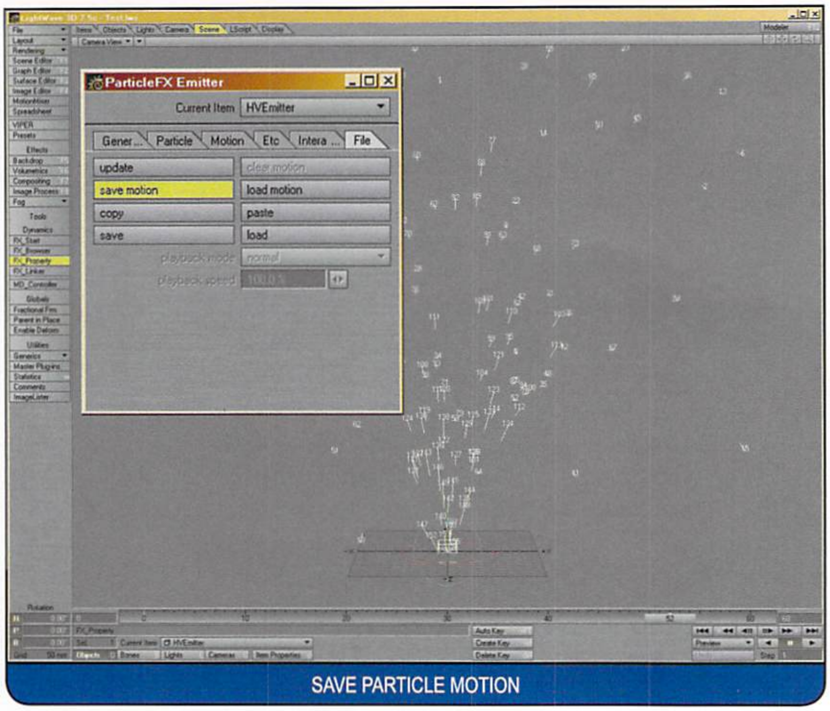
STEP 17 – ACTIVATE "SHOW ID" OPTION


Motion Options for Apple
Parent Item
Unparent
Target Item
IK and Modifiers
Controllers and Limits
Align to Path Look-ahead
Unaffected by IK of Descendants
Goal Object
Full-time IK
Goal Strength
Match Goal Orientation
Keep Goal Within Reach
Add Modifier
Edit
On
Name
ParticleFX LINK
OK
Cancel
33
93
5
138
123
13
54
42
114
40
83
12
49
140
15
14124
102
19
84
13

Parent Item (none)
Target Item (none)
Goal Object (none)
✓ ParticleFX Link <HVEmitter> 0
Particles HVEmitter
Rotation non
time shift non
pre behavior stay
post behavior stay
distance/sec 1 m
Node 82
☐ Size effect
☐ Make key

PARTICLEFX LINK WINDOW

But wait! There's more! I suppose that you've noticed that although the apple is flying up into the air, it looks as if a steel rod is up its butt. Quite unnatural. What it needs is a little bit of spin, but FX Link itself does not pro-



Current Item HVEmitter

SAVE PARTICLE MOTION

vide for such control. Not to worry. You are able to control the rotation of the object using the Rotation tool and keyframes, ultimately allowing a much greater degree of control than with FX Linker. Plus, if you want to change it, you don't have to reload the scene. (With FX Linker, you are able to designate a range of motion for the rotation and spin of the clones. However, you aren't able to control the clones individually; at least *I* haven't figured it out.)

Try these settings:

23. Select Object

24. Activate "Rotate" tool. (Items/Rotate)

25. Enter the following parameters:
h = 0
p = 1200
b = 0

26. Create keyframe at frame 60.

Voila! The apple will now spin around as it flies into the air.

So, it's just that simple! Now you have some pretty neat tools to play around with. Each one has its own benefits and limitations, so you can use them together depending upon the situation. Not bad.

That being said, there's one slight problem for both FX Link and FX Linker. The motions of the particles are not saved with the scene. This means that if you save the scene and then re-open it, the motions are randomly recalculated. Bummer. Depending upon the circumstances this might not be a problem; however, it can be significant. But Ta-Da! There is a fix.

## FREEZING PARTICLE MOTIONS

1. Select Emitter.

2. Freeze particle motion (Scene/FX_Start). LightWave calculates the motions.

3. Save Motion in desired location (Scene/FX_Property/File Tab/ "save motion" button).

4. Save Scene.

The particle motions should now be fixed and won't be different each time you open the scene, particularly handy when network rendering.

So there you have it. I know it's kind of confusing because both FX Link and FX Linker do similar things, use some of the same tools, yet are accessed from different menus. Go figure! Personally, I think of FX Link as "Object Linker" and FX Linker as "Clone Linker." Maybe that will help.

As always, there are many parameters and adjustments with which you can play. Have fun.

**BRAD AND ANDREA CARVEY** HAVE BEEN DOING COMPUTER ANIMATIONS FOR A LONG TIME. IN 1969 BRAD USED AN ANALOG COMPUTER, WHICH WAS THE SIZE OF A CAR, TO PRODUCE HIS FIRST COMPUTER ANIMATION. ANDREA, AN ARCHEOLOGIST, PREFERS TO DO SCIENTIFIC ANIMATIONS; HER CREDITS INCLUDE PROGRAMS LIKE DISCOVERY CHANNEL'S *UNDERSTANDING CARS.* BRAD IS AN ELECTRICAL ENGINEER AND AN EMMY AWARD-WINNING MEMBER OF THE VIDEO TOASTER DEVELOPMENT TEAM. HE PREFERS TO DO FEATURE FILM WORK. HIS CREDITS INCLUDE FILMS LIKE *MEN IN BLACK, STUART LITTLE, BLACK HAWK DOWN, KATE & LEOPOLD* AND *MASTER OF DISGUISE.*

### *CORRECTION*

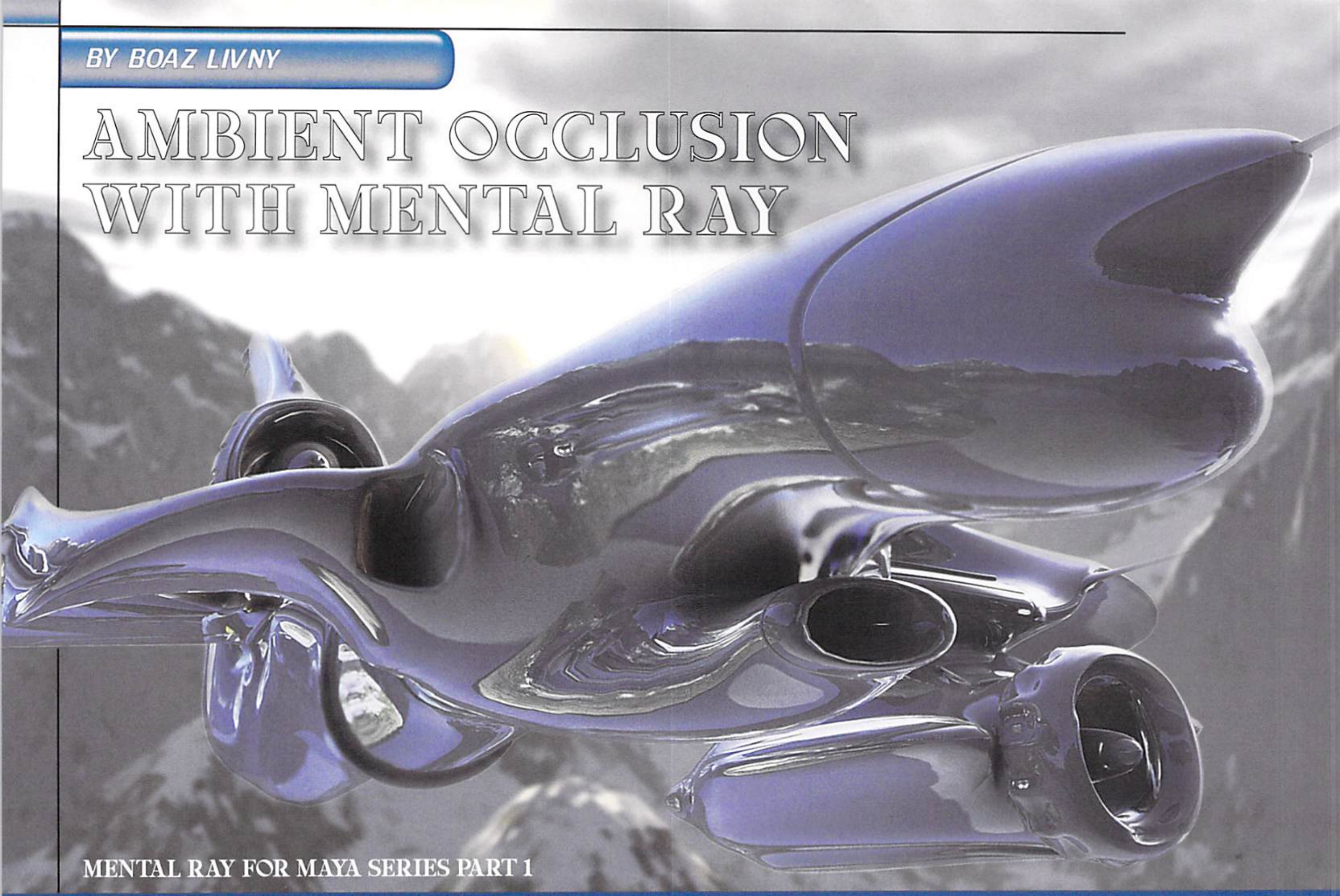
In the FX Linker article, I said that clones couldn't be linked to specific particles. Wrong! Although you can't specify which particles the clones are linked to when they are created, you can specify particles for each clone once they exist. Just select the clone and enter the desired particle number in the "Node" field of the ParticleFX LINK window (Scene/FX_Property). However, it can get a little tedious when you have hundreds of clones.

### BRIEF COMPARISON OF FX LINKER AND FX LINK

| | FX Linker | FX Link |
|---|---|---|
| Access | **Scene** / FX Linker / Particle /FX | **Items** / Motion Options / IK & Modifiers / FX Link |
| Objects | Creates Clones | Uses Individual Objects |
| Attach to Specific Particle | Yes | Yes |
| Spin Control | Yes (Limited Control) | No (Use Keyframes) |
| Undo | Reload Scene & Adjust(esp. w/zillions of clones) | Change Link |

BY BOAZ LIVNY

# AMBIENT OCCLUSION WITH MENTAL RAY



## MENTAL RAY FOR MAYA SERIES PART 1

Like many of us, when I first started working with CG, my goal was to develop modeling and animation skills. I was first introduced to mental ray with Softimage 3D and was extremely impressed to see the quality and sophistication of rendering with mental ray; however, for most of us at that time, using mental ray was far from practical.

My primary interest has always been the capability to simulate realistic lighting and shading properties; I believe that the quality of an image is greatly determined by the quality of the render. Any model can look great, as well as aesthetically pleasing, using just an occlusion render, and even more so with great models!

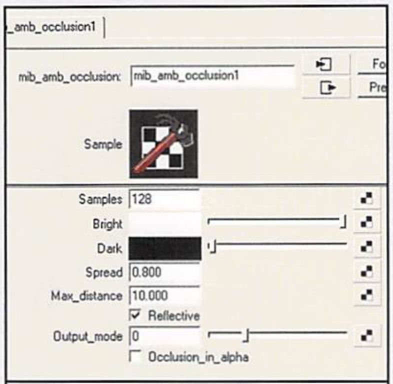
This article will examine how to quickly improve the detail in renders using the mental ray occlusion texture. The great benefit of rendering with occlusion is the ability to achieve aesthetically pleasing renders to show off a model, using a simple shader and the occlusion texture.

Today the rapid improvement in processor capabilities and rendering technologies have made mental ray, as well as other rendering software that mimics real light qualities by using advanced light simulations such as Radiosity, Global Illumination, Caustics, or Final Gather (FG), extremely practical for almost any production. In fact, the process has been further simplified with the ability to bake the lighting simulation into a mapped texture, thus preventing recalculating these costly simulations repeatedly. Essentially, mental ray has become a standard for commercials and has also been used in major films such as *The Matrix Reloaded, The Hulk, Terminator 3* and *Star Wars: Episode 2.*

### WHAT IS AMBIENT OCCLUSION?

Ambient occlusion provides a way for adding realism to images by taking into account the influence of occluding objects while determining the color at every given point on a surface. Occlusion is the process of blocking or the blocking of a passageway; for example, blocking a flow of air. In our context, it is the process of objects blocking the flow of light from each other, which has an effect of darkening the surface area on an object as it gets closer to another surface. This also affects how a surface reacts to its own geometry, such as around folds or creases (self-shadowing).

Occlusion greatly improves realism without any expensive render simulations (such as photon casting). An occlusion texture examines the distance between different occluding surfaces and uses those distance values, between points on each of the surfaces, to determine the influence they should have on the resulting occlusion (darkening) value at each point on the surface. The occlusion texture fakes the calculation of how much light is blocked from the surface based on the distance between surfaces – in other words, how much light is occluded by other objects. As surfaces get closer to each other,



mib_amb_occlusion: mib_amb_occlusion1

Samples 128

Bright

Dark

Spread 0.800

Max_distance 10.000

☑ Reflective

Output_mode 0

☐ Occlusion_in_alpha

FIGURE 1

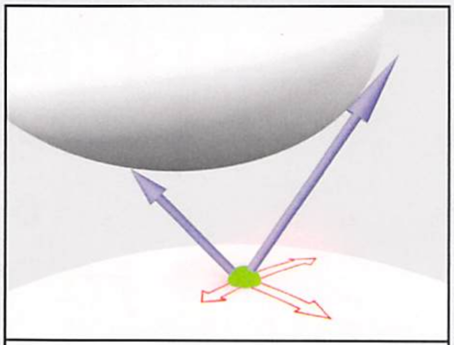


FIGURE 2 - EXAMINING A POINT ON A SURFACE

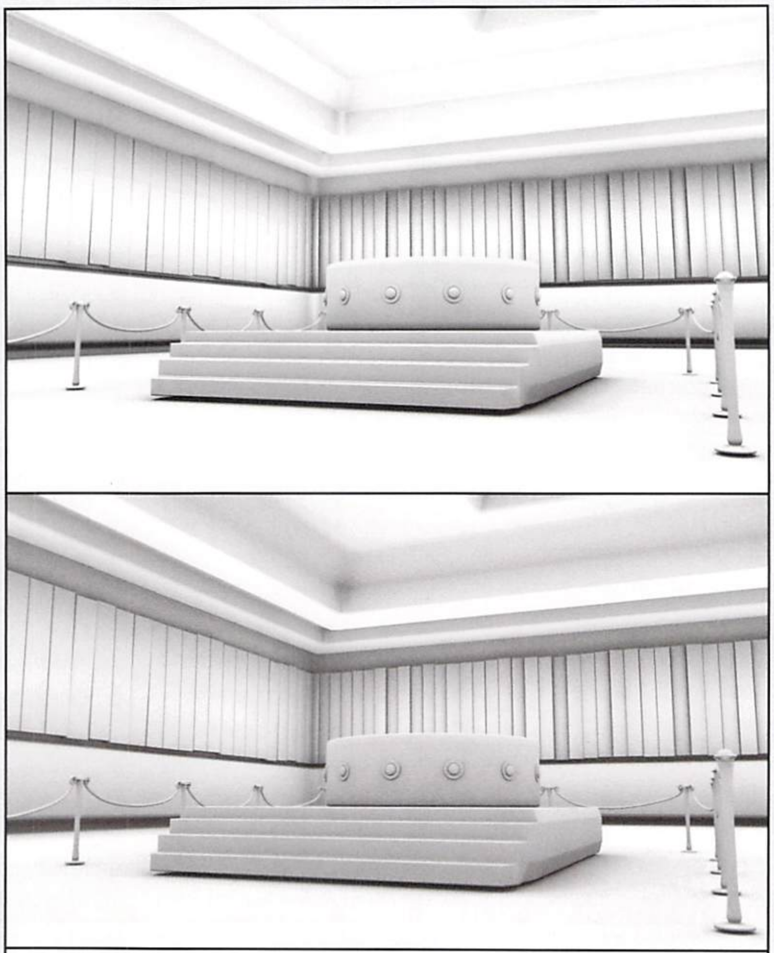


FIGURE 3.0 (TOP) - LOW SPREAD & FIGURE 3.1 (BOTTOM) - HI SPREAD

the occlusion influence rises and the surfaces will get darker in the neighboring regions.

## WHAT IS OCCLUSION USED FOR?

The process of ambient occlusion within mental ray uses a texture node, allowing us to use it in several interesting ways. The most apparent use for the occlusion texture is to retrieve the self-shadowing values – as well as influence from surfaces within close proximity – as a simple grayscale image that describes the diffusive occlusion color values across the surface (figure 3). We can choose to bake the diffusive ambient occlusion calculation into an image file, use it within a shader, or use it as a separate render pass for compositing (most common).

The ambient occlusion texture can be used to retrieve diffusive and reflective occlusion, normal maps, and environmental sampling passes. We will examine all of these within this article.

## THE AMBIENT OCCLUSION TEXTURE NODE

Fortunately, the newest release of Maya (6.5) has included an occlusion texture that in previous versions of Maya required a custom installation. You will find the ambient occlusion texture under the mental ray nodes texture tab in the Hypershade window. Ironically, it's the first texture on the list and probably one of the most important ones.

If you examine the attributes of the ambient occlusion texture, you will see that you can set the quality of the occlusion by increasing the samples; a higher value will improve the quality of the render, but also increase the render time. The next two attributes, Bright and Dark, give you the choice of colors to determine the color range for the occlusion, with Bright being the areas that receive no influence and Dark being fully occluded areas.

The Spread and Max Distance define how much influence an occluding surface has on a given point (green surface, fig.2) and how far the rays travel to examine for occluding surfaces respectively (blue arrows, fig.2). A higher Spread will darken out a larger region from a given point (Red arrows in fig. 2 and figures 3.0-3.1) The Mode attribute determines what type of pass we would like the occlusion texture to calculate: at 0 it is used for diffusive and reflective occlusion, at a value of 1 it will render an environment sampling pass (see environment sampling), and at values 2 and 3 it renders a normals pass.

It is important to understand that diffusive ambient occlusion tries to mimic the influence of occluded light by examining the distance between two surfaces and determining how to darken them based on the settings we choose. This is not a light simulation using

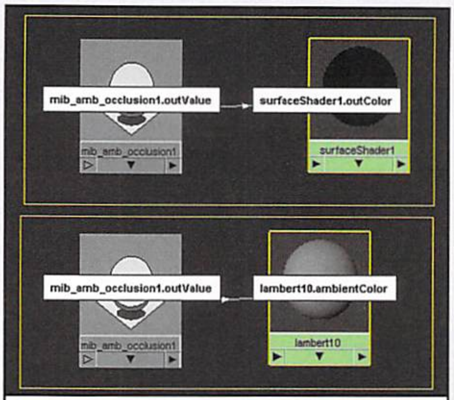


FIGURE 4 - NODE CONNECTIONS

photons, but rather an affordable cheat that can greatly improve images and save time.

## DIFFUSIVE AMBIENT OCCLUSION SHADING NETWORKS

We will now examine the properties of diffusive ambient occlusion, which is the process of getting an occlusion map for the diffuse light properties of a surface. To use the ambient occlusion for generating any occlusion pass, you connect the out value from the occlusion node to the ambient color of any shader, typically the Lambert shader or the out color of a Surface shader (Figure 4).

The Surface shader in Maya provides you with a way of viewing the exact color on an object without any shading influence such as light. If you are not familiar with the Surface shader, when rendered it displays the exact color based on whatever you connect to the out color value, despite any lights in the scene (example, an image texture for a background sky). So one of its many uses would be to apply a baked illumination texture to its out color value so you can render a sequence of frames with no heavy light calculations. If you've baked textures before, you may have noticed that Maya assigns baked textures to a Surface shader node by default. If you haven't used the Surface shader before, I recommend the following exercise: Load an image file into a scene with no illumination (disable the default light) and apply the image file to the out color attribute of a Surface shader. Connect the shader to a simple plane and render an image. The result will clarify the strength of this shader.

When examining the difference between using a Lambert (or any other typical shader) shading model vs. the Surface shader shading model for retrieving an occlusion pass, we will notice the following behaviors:

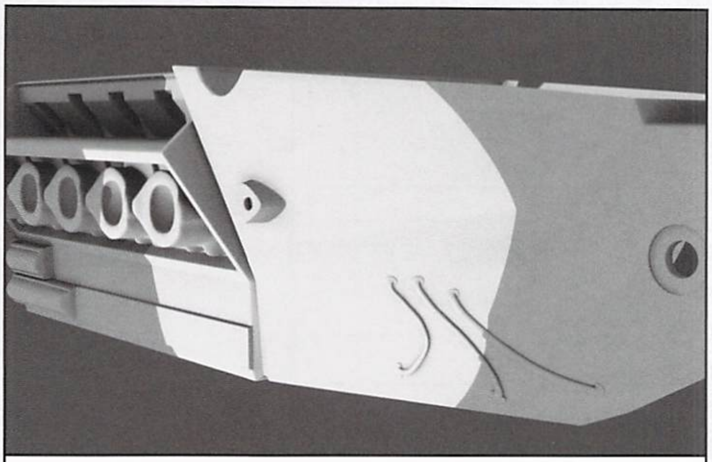


FIGURE 5 - LAMBERT SHADER WITH DEFAULT VALUES. NOTE THE LIGHT INFLUENCE

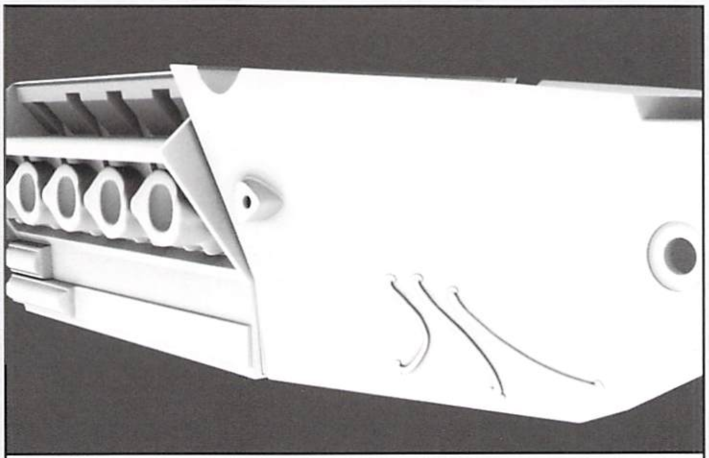


FIGURE 5.1 – SURFACE SHADER

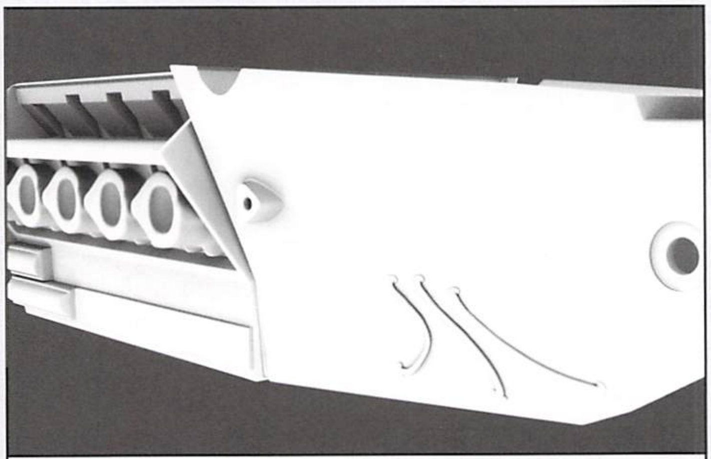
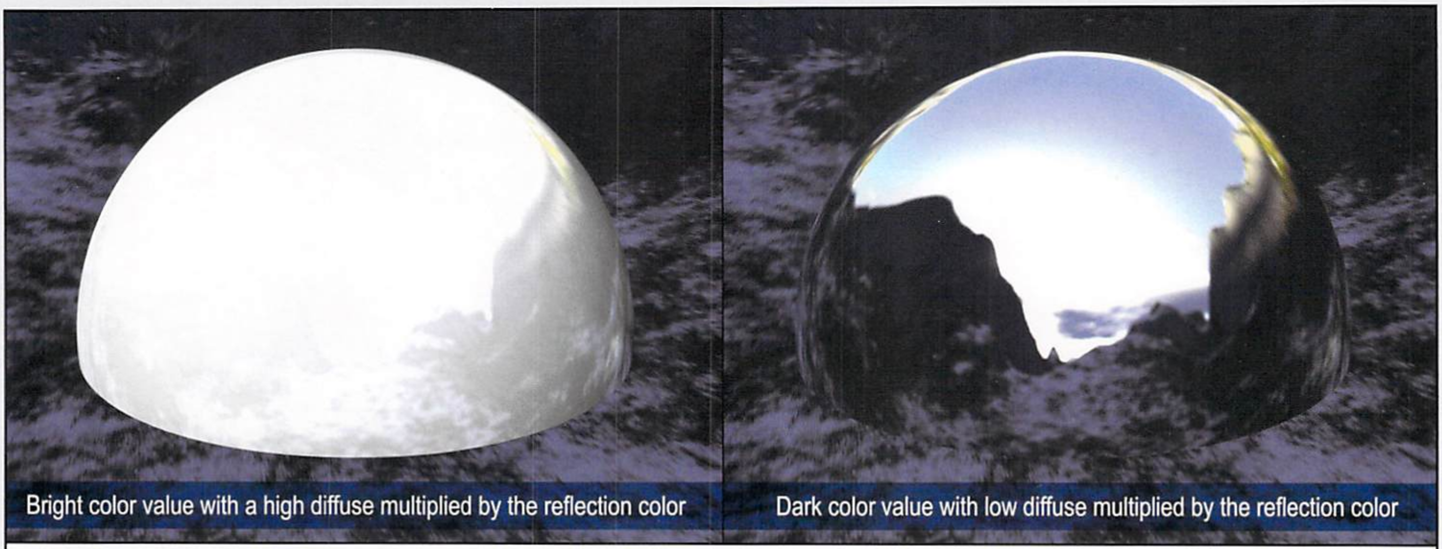


FIGURE 5.2 – LAMBERT SHADER WITH A DIFFUSE VALUE OF ZERO AND A WHITE COLOR VALUE

1. Using the Lambert shader or any other (Blinn, Phong) shading model, and connecting the occlusion texture to the ambient color attribute on the shader. An ambient color value acts as a multiplier for the color value. The occlusion texture that is connected to the ambient color value will render out details of darker / brighter based on occluding objects and then multiply it with the color attribute values to determine the color for each point in the rendered image. The rendered image will have also been influenced by the shading model attributes, such as the diffuse and specular color values as well as influence from lights in the scene (figure 5.0). In the case of a Lambert shader, if you set the diffuse value to zero and the color value to white (figure 5.2) then the result will be the same as using a surface shader (figure 5.1). This is because a shader with a zero diffuse value will not be influenced by any lights in the scene. Also, you need to set the color value to white so that the ambient color is multiplied with a color value of one (white). If you where to keep the default grey color value, the rendered occlusion would only be as bright as that value (grey value of 0.5). To explain this mathematically, a calculated value of 1 from our occlusion texture (one/white being the value of a non occluded area), is


Bright color value with a high diffuse multiplied by the reflection color

Dark color value with low diffuse multiplied by the reflection color

FIGURE 5.3 – REFLECTION VALUES

multiplied by the value of the color attribute, lets say 0.5, thus the brightest point on the surface could never be brighter than a value of 0.5 (0.5*1=0.5 which is the color value* ambient occlusion = the max value).

2 The Surface shader will provide a render where the values are solely driven by the occlusion shader, thus providing, in my opinion, a better render pass for compositing (figure 5.1). The Surface shader has an out color value that defines its rendered color value vs. other shading models that have ambient, diffuse, and other attributes that affect the final color values.

As you can see, the Surface shader diffusive occlusion pass looks much more like the kind of pass we could use in a compositing tree. Note that you might want to adjust the Dark value so that when multiplied by the color value in a composite, the result won't completely darken the colors at the fully occluded areas. The Bright value should always remain white so there won't be any influence on the overall color at non-occluded areas.

## AMBIENT REFLECTIVE OCCLUSION

The occlusion texture lets you do much more than calculate diffusive ambient occlusion, by allowing you to calculate reflective ambient occlusion. If we mimic realism, we would simulate the properties of natural light being scattered off an object – this would include diffusive reflected light as well as specular reflected light. Both take part in determining the color of a surface point by mathematically adding the reflection value onto the diffusive color value. So if you have a very dark surface color and you add the reflected color, you should see an almost accurate reflection color value, however if you add a reflected color onto a bright color, the reflection might appear washed out (figure 5.3). For example, shading a mirror is best achieved by using a shader with a dark color and a low diffuse value, since we primarily want to see the color of the specular reflection.

The technical difference between rendering a diffusive occlusion vs. a reflection occlusion pass is in how the occlusion is calculated. With the diffusive occlusion, the influence is calculated based on the surface normals, whereas the reflected occlusion is calculated based on the reflection rays.

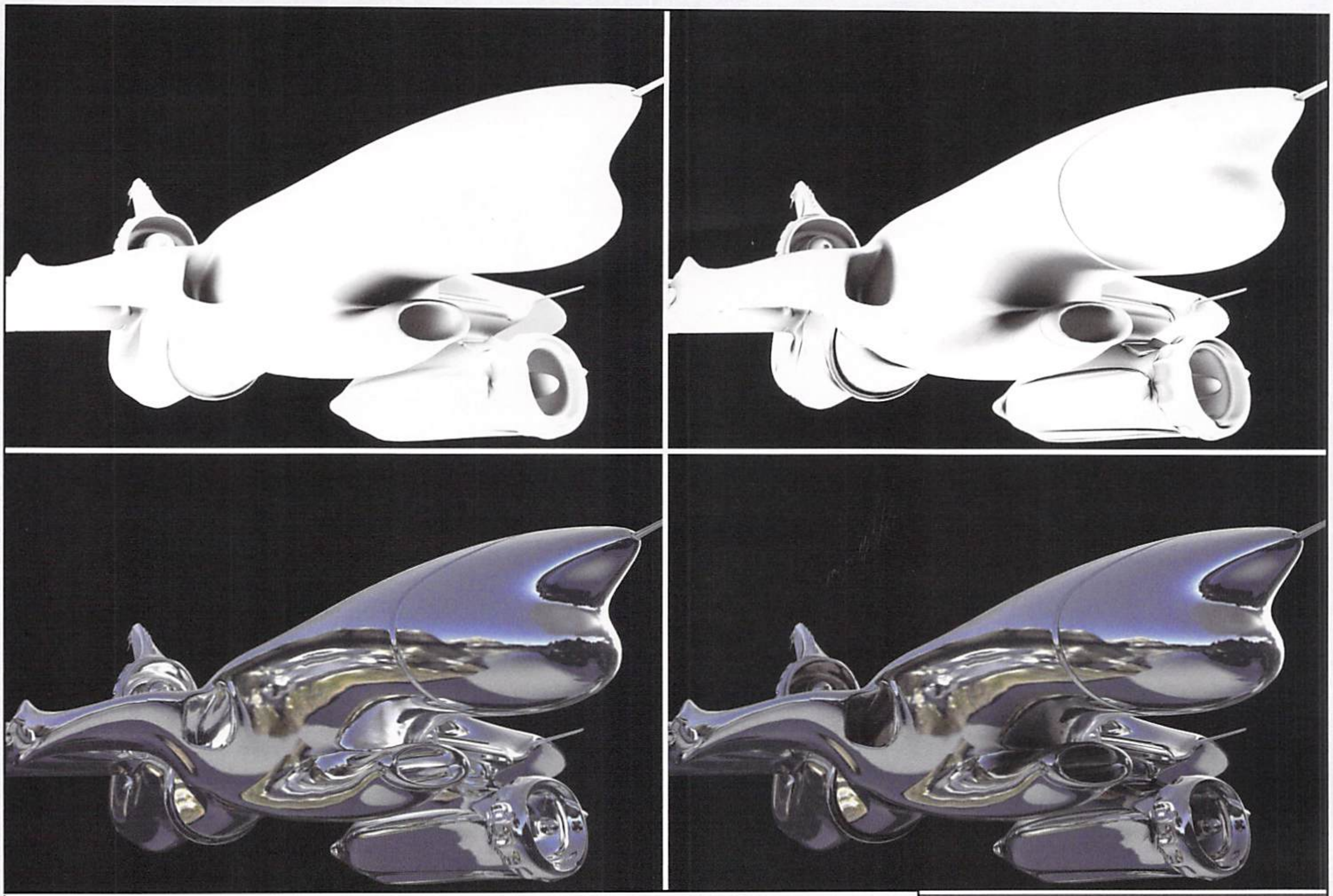
## WHY WE NEED REFLECTIVE OCCLUSION

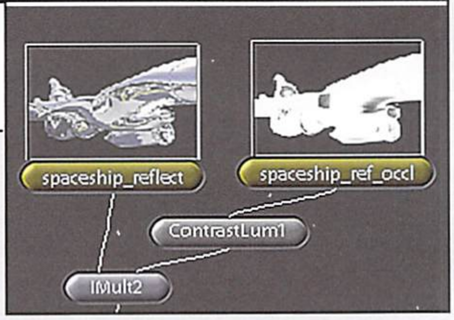
In CG, if the reflectivity value is set to full (100% reflective), then each point on that surface will have the same amount of reflection. In real life, though, objects reflect unevenly based on their shape and physical properties, as well as how much light is occluded by other objects, folds, and creases, just as in the case of diffusive ambient occlusion. Reflective ambient occlusion provides a way to control the amount of reflection color along a surface based on the reflection rays.

The primary consideration with reflective occlusion is how to control the amount of reflection at each point on the surface. The occlusion texture provides us with a grayscale map that can be used to vary the reflection values along the surface. In order for us to adjust the reflectivity amount based on the grayscale occlusion map, we must multiply the result of the reflected ambient occlusion (the grayscale map) with the overall reflectivity value at each point across the surface. The result would be a reflection pass that would scale the amount of reflection across the surface, based on the reflective occlusion map, rather than an overall linear value.

## COMPOSITING REFLECTIVE AMBIENT OCCLUSION

While compositing a standard color pass with a reflection pass (figure 6.4), the reflection pass is a combination of both a fully reflected pass (figure 6.2)





*TOP LEFT*– FIGURE 6.0 - DIFFUSIVE OCCLUSION, *TOP RIGHT*– FIGURE 6.1 - REFLECTION OCCLUSION
*BOTTOM LEFT*– FIGURE 6.2 - FULL REFLECTION (CHROME SURFACE),
*MIDDLE RIGHT*– FIGURE 6.3 - COMPOSITE– MULTIPLIED REFLECTION PASS WITH REFLECTIVE OCCLUSION PASS,
*BOTTOM RIGHT*– FIGURE 6.4 - SHAKE : REFLECTION + REFLECTION OCCLUSION

multiplied by the reflected occlusion pass (figure 6.1) to give the reflection more variation on the surface. Then the resulting reflection pass (figure 6.3) is added to the color pass that is also multiplied by a diffusive occlusion pass ((Color*Diffusive Occlusion) + (Reflection * Reflected Occlusion)).

To clarify, a fully occluded point that is multiplied by its fully reflected pass, would yield a reflection value of zero for that point—no reflection exists at that point. So if the reflected ambient occlusion is equal to a value of zero (fully darkened area), the reflection value of one (fully reflected), multiplied by an occlusion value of zero, will be equal to a value of zero and have no reflected color at that point (0 occlusion * 1 reflection = 0 reflection).

One of the noticeable differences between a reflection occlusion pass vs. a diffusive occlusion pass is the fact that the reflected occlusion pass yields more darkening in flat areas (figures 6.0 – 6.1). Some CG artists refer to occlusion as dirt maps because of the way it provides darkening in tight spots on a surface as well as the darkening influence from other objects. In such a case, you might prefer the reflected occlusion pass, as it has a more interesting darkening affect, as well as defines surfaces more clearly. The additional darkening is due to the fact that the reflective occlusion pass darkens areas based on the reflection rays, whereas the diffusive occlusion pass calculates its affect based on the surface normal.

## METHODS FOR RENDERING AMBIENT REFLECTIVE OCCLUSION

Before we examine reflective occlusion, I would just like to point out that I am using HDR Images with an IBL (image based lighting) light node, available from the mental ray render globals tab. Rendering reflective occlusion is as simple as enabling the reflective check box in the occlusion texture node; you can then render reflective occlusion in a number of ways:

- You can render a reflective occlusion pass with the same network as used before (figure 4), just with the reflective checkbox enabled. The resulting render is a reflective occlusion pass that can be used by multiplying the result with a reflection pass in a compositing package (Figures 6.1 - 6.4).

- You can also combine the reflection and the reflective occlusion into a shader by driving the reflection amount over the surface in some of the following ways:

1. Connect the out value from the occlusion to an "RGB to Luminance" node and use the output as a reflectivity value (see shader setup 3).

2. Create a specular shading model that is multiplied with an occlusion texture using the "multiply / divide" node and then connected to the out color on a surface shader node (see shader setup 2).

3. Connect the occlusion texture out value to the specular color value of a shader (see shader setup 1).

In summary, all of the above methods provide a way for controlling the reflection value across the surface, their purpose is the same: the scaling of the reflection value at each point across the surface based on the occlusion texture attributes. The main difference is whether you plan on compositing the reflection and reflective occlusion pass within a compositing package or whether you would rather create a single shader that has the occlusion texture multiplied with the reflection values at render time. The latter would be creating a specular reflective shading model that is multiplied with the occlusion texture; this process will be clarified in the following shader examples that will show some of the different approaches you can take. Notice that the main difference will be in the approach to establishing the shading networks connections rather than the end result.

### SHADER SETUP 1

**Methodology:** Assuming the reflection attribute is enabled, the specular color value controls the reflection amount along a surface. A black specular color is equal to no reflection, whereas a bright specular color will provide for full reflection. The following connection uses the reflective occlusion texture value as a map for the specular color that then acts as a scale for the reflection values across the surface based on the dark / bright occlusion texture values.

**Process:** Enable the reflection checkbox, and then connect the ambient occlusion texture *out value* to the *specular color* value on a reflective shader such as a Blinn or Phong node. Make sure that the reflection value is set to a value greater than zero (try a value of one). Use the reflection value as an overall scale factor for the reflection.

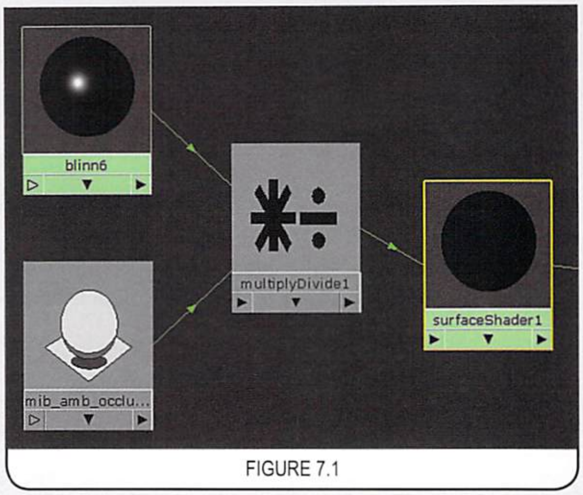


FIGURE 7.1

### SHADER SETUP 2 (FIGURE 7.1 & 7.4)

**Methodology:** Using a Surface shader to pipe out the reflection value multiplied by the reflective occlusion value. This is achieved by taking a fully reflective shader and then multiplying it with an occlusion texture, using the Multiply Divide node. The result is then passed to the surface shader *out color* that will show the combined result in the rendered image regardless of any existing lights.

*PROCESS:*

1. Create a reflective Blinn (black color with a low diffuse, high specularity and fully reflective)

2. Create a Surface shader, an occlusion texture and a multiply divide node (Maya utility node, make sure it is set to multiply)

3. Connect the Blinn *out color* to the multiply divide node *input 1*

4. Connect the Occlusion *out value* to the multiply divide node input *2*

5. Connect the *out value* from the multiply divide to the *out color* of the Surface shader (just middle mouse drag the multiply divide node onto the *out color* value)

Note that the Blinn passes its *out color* to the Surface shader, this out color is the result of all the values from the Blinn's attributes (color, ambient color, reflection, diffuse...), thus when using a fully reflective (chrome type) shader, with no diffuse and a high specular value, the resulting out color will be equal to a full reflection color pass that is then multiplied with the multiply divide node, by the grayscale map from the occlusion texture. This method was demonstrated by Paolo Berto, from mental Images, in the 2004 Alias master class papers.

### SHADER SETUP 3 (FIGURE 7.2)

**Methodology:** Using an RGB Luminance node we will convert the out value from the occlusion texture (which is an RGB value) into a single value that can be used as a scale for the reflectivity value, a single number value. For MEL users, we are converting the color value (a vector) into the reflectivity single value (a float).

*PROCESS:*

1. Create a reflective Blinn (black with a low diffuse, high specularity and fully reflective)

2. Create an occlusion texture and a RGB to Luminance node (Maya utility node)

3. Connect the occlusion out value to the RGB Luminance node in value

**4** Connect the luminance node out value to the Blinn's reflectivity value (make sure you connect to reflectivity not the reflection color attribute)

**5** Further, you can use the out color from the Blinn as a connection for the out color on the surface shader. Also, you can create a ramp that acts as a scale for the occlusion texture and therefore controls the range and contrast of the final render.

## SHADER SETUP 4 – CLEARCOAT (FIGURE 7.3 & 7.6)

**Methodology:** This is just a quick example of how the occlusion texture can be piped into a network to help achieve a more realistic effect. I am not going to explain how to create a clear coat shading network, as this is a common practice that is described in various tutorials and books, including the Alias Web site and the Alias rendering book. The clear coat in this example tries to improve the way the reflection is calculated across a surface, as the surface geometry bends away from the camera. In this case, I use two ramps that help define the reflection and specular values based on the surfaces direction from the camera (Sampler info node). The entire shader is then transferred to a multiply divide node and multiplied with the occlusion texture; the result is the reflection pass with the affect of the clear coat shading characteristics, as well as the camera viewing angle (sampler info) influence and, of course, the reflective occlusion texture influence.

**Process:** Using the same setup from shader setup 2, just replace the Blinn with a layered texture that is a clear coat shading network.

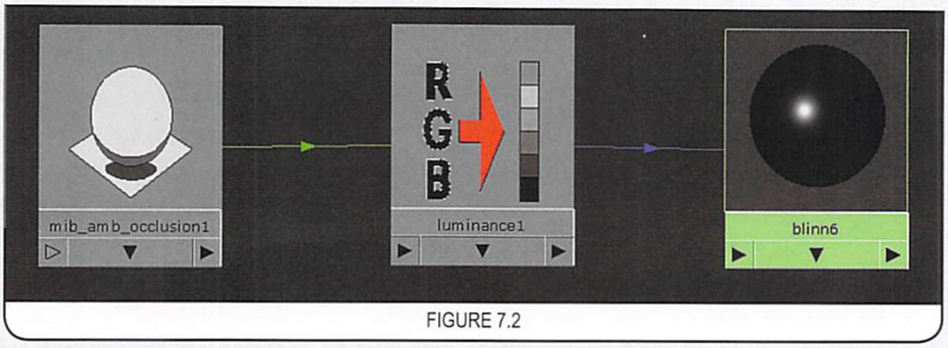


FIGURE 7.2

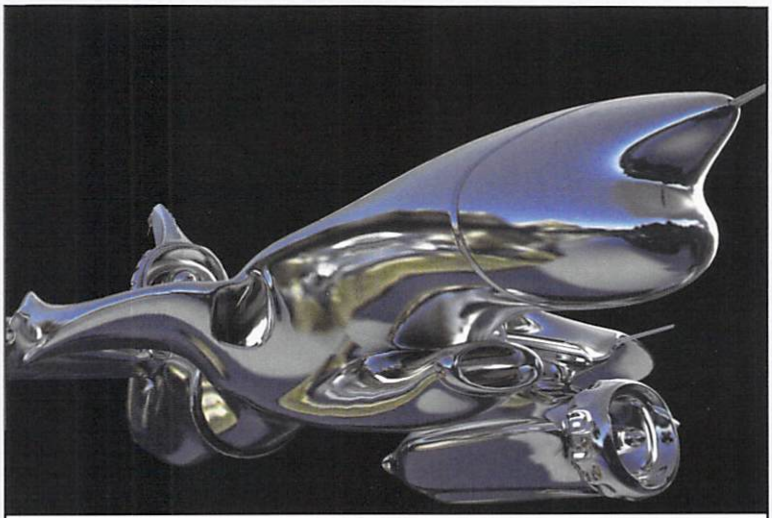


FIGURE 7.3 –USING THE LUMINANCE TO RGB NODE

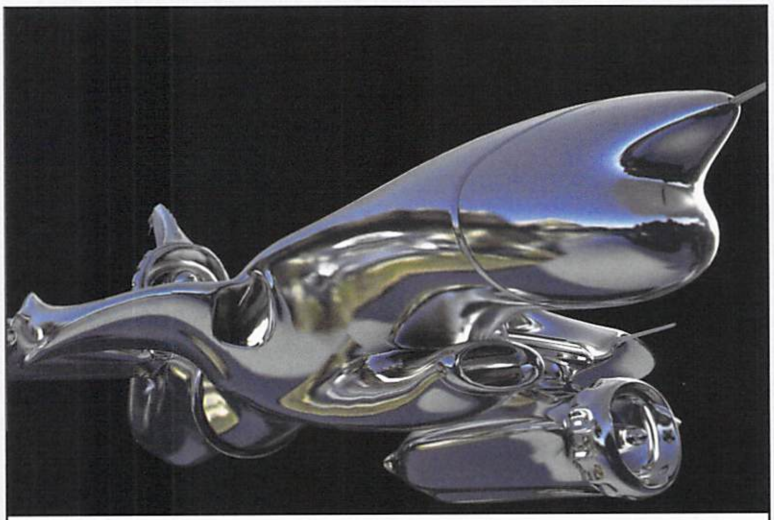


FIGURE 7.4 – SURFACE SHADER WITH MULTIPLY NODE AND OCCLUSION

## ENVIRONMENT SAMPLING AND NORMAL MAPPING

Besides occlusion passes, the ambient occlusion texture provides a way to retrieve normals and environment sampling. These are enabled by choosing different rendering modes from the ambient occlusion texture Mode attribute. I will not get into much detail, especially with the normal mapping, as it in itself is a topic for a lengthy article.

**Mode 1:** Environmental sampling, this is the process of retrieving the influence from the environment on our model based on the diffusive or reflective occlusion lookup, this means that you can choose if you want to examine the environment influence based on the surface normals (diffusive occlusion) or the reflection rays (reflective occlusion).

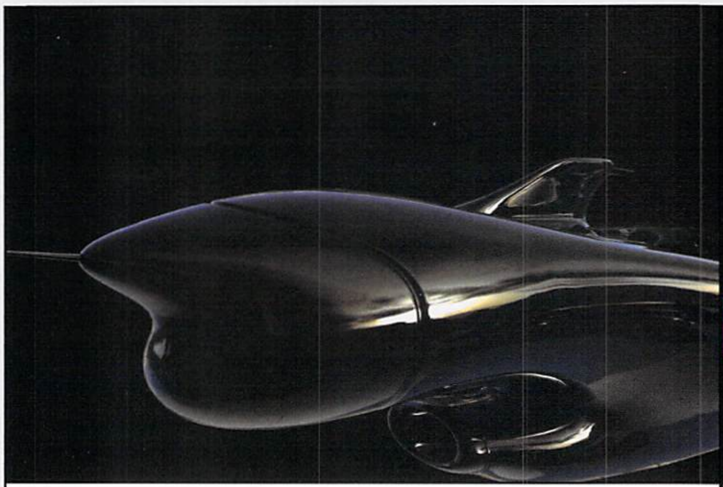


FIGURE 7.6 CLEARCOAT RENDER

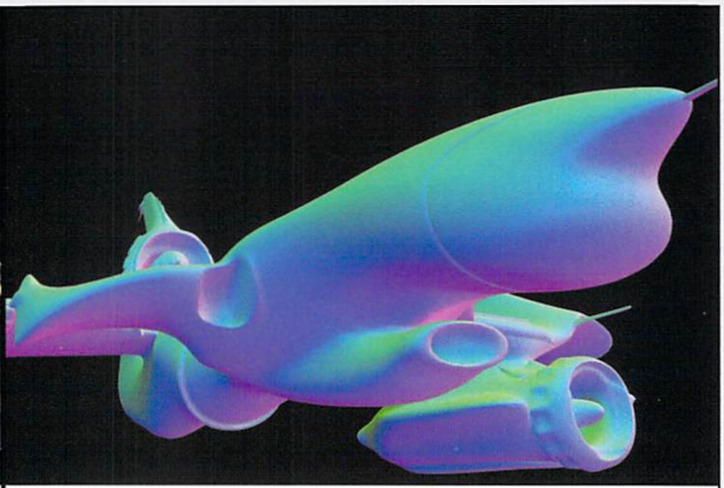


FIGURE 8.0 –NORMAL MAP

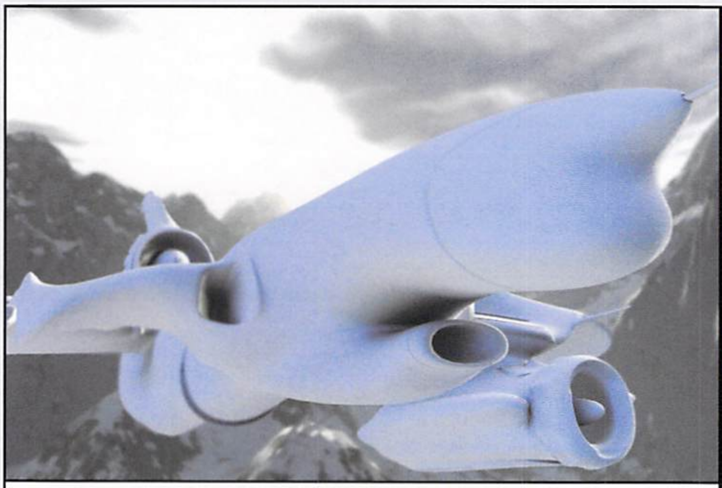


FIGURE 9.0 - ENVIRONMENT SAMPLING

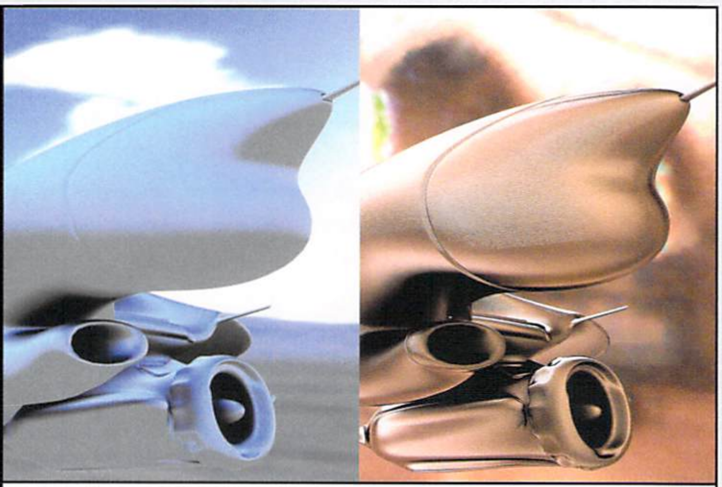


FIGURE 9.1 - ENVIRONMENT SAMPLING

In my opinion, it has many similarities to rendering with image based lighting, but rather than taking the time to calculate many lights, or use expensive render simulations such as final gather, it simply speeds up the process of getting the environments influence on each point on the surface. In the case of environment sampling, we retrieve color values from the environment and multiply them by our surface color; this in return can be used as a render pass or part of a procedural shading network. The following examples show the influence of different HDR images on a model using the occlusion texture and a surface shader (figures 9.0 – 9.1); figure 10 shows figure 9.0 composited with the clearcoat reflective occlusion pass (shader sample 4).

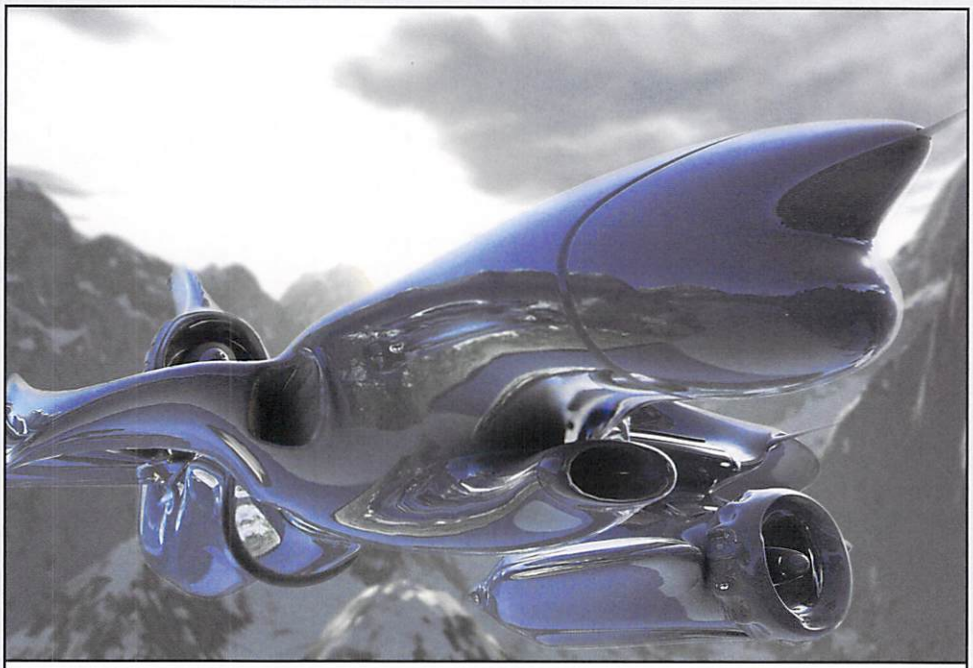


FIGURE 10 - ENVIRONMENT SAMPLING COMPOSITED WITH A CLEARCOAT REFLECTION PASS

**Modes 2 and 3:** these modes enable rendering normal mapping passes based on the world coordinate system (mode 2) or the camera coordinate system (mode 3).

The colors represent the directions in the coordinate system you choose, where x, y, z are represented by red, green, and blue, respectively. If you are not familiar with the usage of normal maps, you can learn about this from tutorials available on many 3D sites.

### IN OCCLUSION:

There are several different connections you can create based on these examples and some of your own added creativity. We examined much more than rendering ambient occlusion in this article; some of the information I covered refers to the usage of some very useful utility nodes as well as piping shading networks through the surface shader and understanding the compositing tree for occlusion using a node based compositing software. I would like to point out that you can adjust the levels for the occlusion map to resolve any artifacts that may appear in the occlusion render, as well as control the overall occlusion darkening affect.

The occlusion, in my opinion, is best used as a separate pass for compositing, enabling you to make last minute changes to your image. Remember that a lesser reflection value does not blur a reflection, it just renders less of it, or you may say adds a lower reflection color value onto the diffusive color value, thus all it really does is darken (reduces) the reflection amount, which is why I would rather apply it in the composting stage.

The diffusive occlusion is especially handy if you would like to present your models clearly, with some self-shadowing and an aesthetic render. Also, I find that the diffusive occlusion pass adds a lot of realism to character faces, which are naturally full of creases and folds.

I hope you enjoyed this article. In the next article in this mental ray for Maya series, we will examine texture baking with mental ray.

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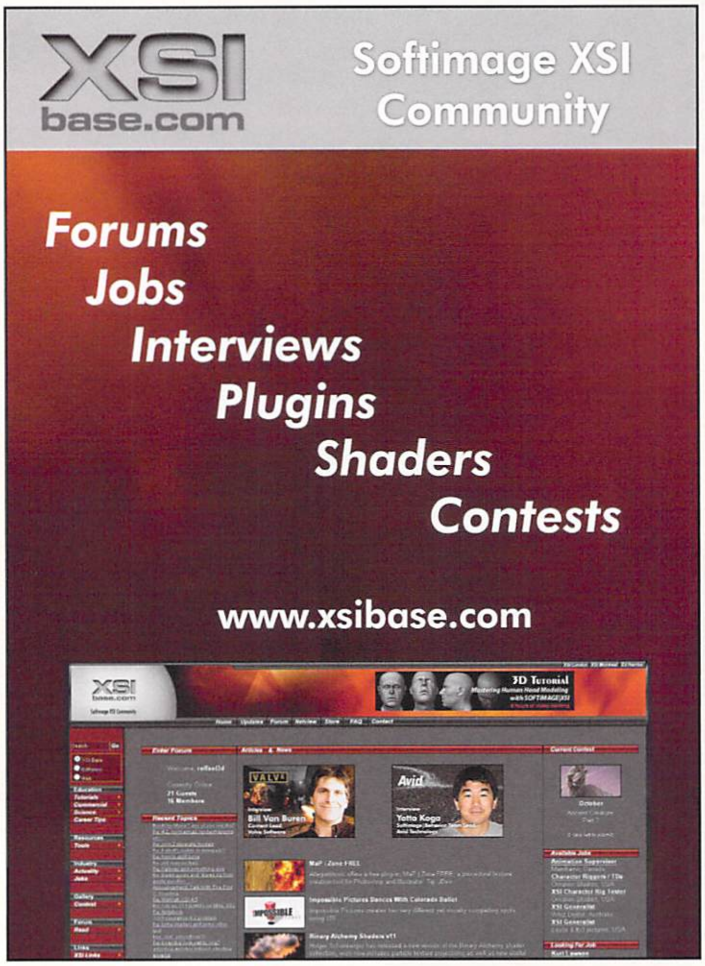

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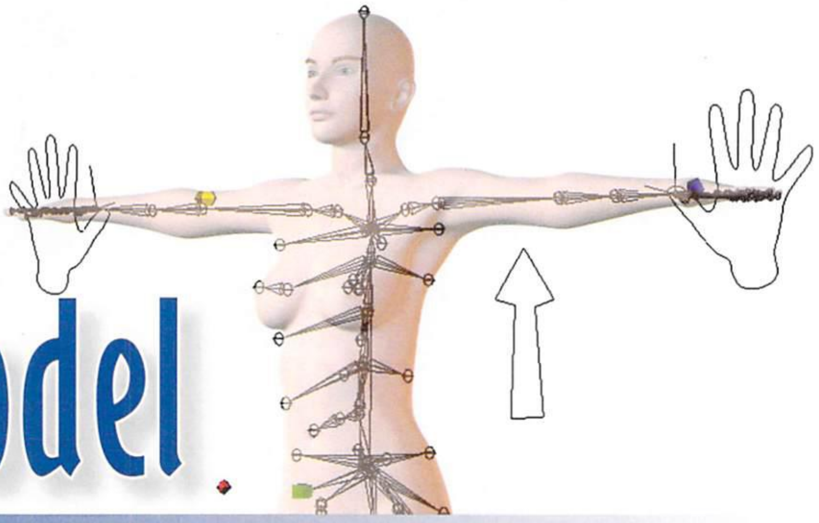


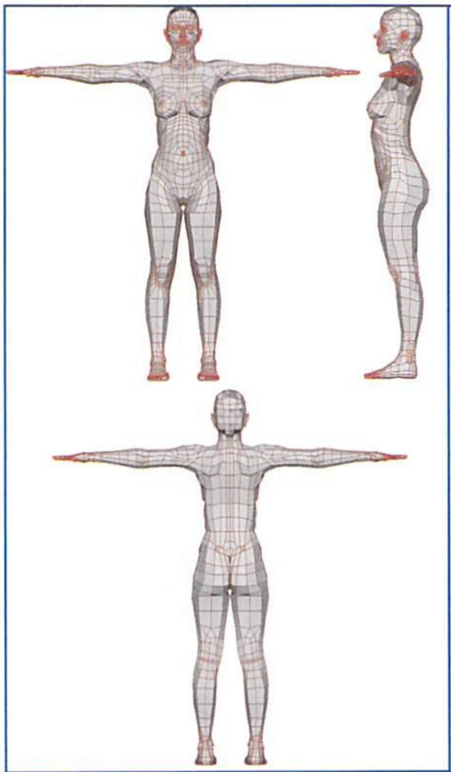
## PART 2

This is a continuation from the last article on setting up a human for animation. Since rigging is a very involved process, this tutorial will extend over several more issues. As a former LightWave user (teaching it for over 10 years), I found many similarities as well as differences between the way rigging is done in Maya. Since the NewTek team is asking for suggestions on how to improve future versions of LightWave, some of you may find it useful to learn how Maya accomplishes certain rigging tasks so that you can request similar features in future upgrades of LightWave.

Before you start the rigging process, make sure that you have a high-res smooth mesh surface version of your person in one layer and the low-res proxy mesh type in another layer *(Figures 1 and 2).*

Notice that the model is in the typical T pose. This is the position that makes modeling easier when using templates, since most of the time they are straight orthographic views of the model. The T pose also makes it easier to UV texture a character, since the geometry is already facing directly on the X, Y, and Z-axes, rather than at angles which can cause distortions in the extrapolated UV maps.

Another important consideration is topology. It is something that cannot be stressed enough when designing your character. If your polygons and their edges do not flow with the orientation of muscles and bones that are visible on the surface, then the model will not deform correctly when you are posing it. No matter how much you work with the weight maps, you are bound to run into all kinds of frustrations. Creating a model with the right kind of topology is also very important for facial animation with blend shapes or morph targets. It is much easier to make these when the polygons flow in the same direction as the muscles of the face. Modeling a human with the right kind of topology will be discussed in a future issue.



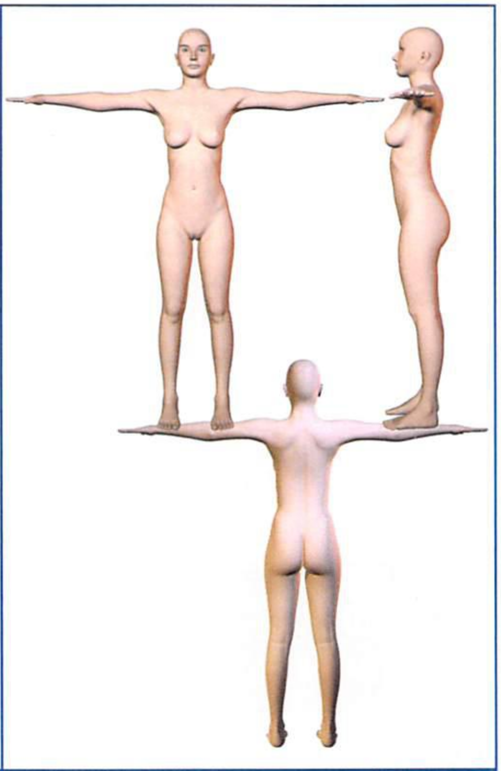


FIG. 1 *(ABOVE LEFT)*– THE TOPOLOGY OF THE LOW POLYGON MODEL (PROXY MESH)
FIG. 2 *(ABOVE RIGHT)*– THE SMOOTH MESH MODEL THAT IS PLACED IN A HIDDEN LAYER.

### CREATING THE JOINTS (BONES)

Using the model as our template for the placement of joints, the following steps show

how to create the different components of the skeleton. This is probably the easiest part of the rigging process.

Make your side view large and hide the hi-res smooth mesh layer so that you can only see the low-res proxy version *(Figure 1).* Make the shader of the low-res proxy semi-transparent or go to the side view Shading menu and select *Shade Options > X-Ray.*

## STEP 1

Create a new layer for your skeleton. Select the Joint by going to *Skeleton > Joint Tool > Options.* In the options box, set the Orientation to None and close the box. Later, we will orient the joints to point toward the bones manually. In your side view, click with the tool at the hip area. If the first joint is too large or small, go to the Display menu and select Joint Size. Click at the knee to make the second joint. Click at the ankle for the third joint, the middle of the foot for the fourth one, and finally in front of the toe to complete the leg and foot joints.

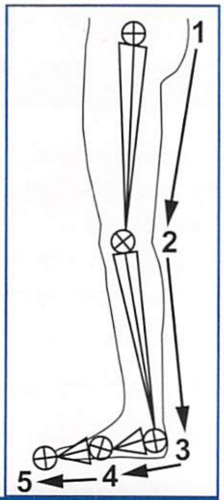


FIG. 3– STEP 1, USING THE JOINT TOOL TO MAKE THE LEG BONES IN THE SIDE VIEW

## STEP 2

Go to your front view, click on the top joint, and move the leg skeleton into the center of your character's left leg *(Figure 4).*

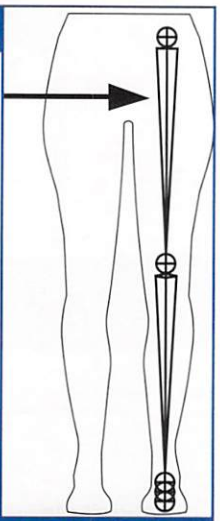


FIG. 4– STEP 2, THE LEG BONES ARE MOVED IN THE FRONT VIEW TO THE MIDDLE OF THE LEFT LEG

## STEP 3

Label each joint by selecting the top and name it "L_hip." Use your down arrow to select the knee joint and rename it "L_knee." Each joint should have the following names:

L_hip
L_knee
L_ankle
L_ball
L_toes

For those of you who are lazy about naming joints, try this. Select the top leg joint and go to *Modify>Prefix Hierarchy Names...* Type "L_Leg_" and click OK. This will name all the joints in the chain with the "L_Leg_" prefix.

## STEP 4

In the side view, starting slightly above the hip joint, use the Joint tool to create six spine bones, and one neck and one head bone *(Figure 5).* Starting at the hip area and working your way up, rename the joints with the following names:

spine1
spine2
spine3
spine4
spine5
spine6
neck
head
skull

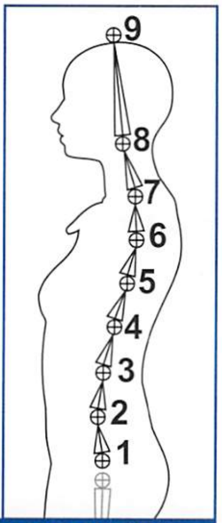
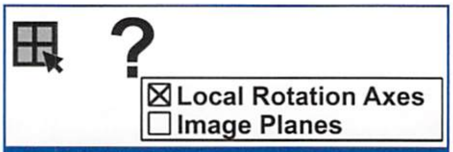


FIG. 5– STEP 4. CREATING THE SPINE, NECK, AND HEAD JOINTS IN THE SIDE VIEW

## STEP 5

Now it is time to reorient the joints so that they point toward the same direction as the bones. Hide the layer that shows your polygon object. Select the root spine joint that you named "spine1" and go to *Display > Component Display > Local Rotation Axes.* If you have not done so already, you might want to make a shelf button for this command.

Click the Select by Component Type icon in the Status Line to turn on the Component Selection mode, and also click the Miscellaneous (?) mask icon in the Status Line. Right-click the Miscellaneous (?) mask icon and turn on Local Rotation Axes *(Figure 6).*



☒ Local Rotation Axes
☐ Image Planes

FIG. 6 STEP 5, TURNING ON LOCAL ROTATION AXES IN COMPONENT MODE

Select the Rotation tool. Click on the X, Y, or Z-axes name or the axes lines found inside the joint. Rotate the joint in the side view so that its Y-axis faces toward the bone above it. Only the joint should rotate, while the bone remains stationary. Continue working your way up until all the joints have their Y-axes facing toward the bones above them *(Figure 7).*

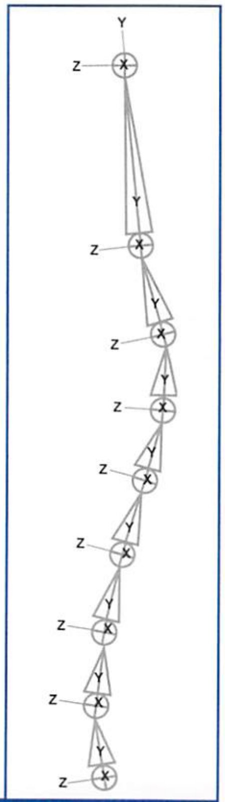
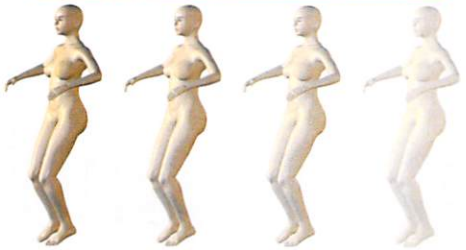


FIG. 7– STEP 5 CONTINUED, USING THE SIDE VIEW TO ORIENT THE Y LOCAL ROTATION AXES OF ALL THE JOINTS SO THAT THEY FACE TOWARD THE BONES ABOVE THEM



Orient the leg joints so that the upper and lower leg joints' Y-axes face in the same direction as the bones above them. The Z rotation axes of the ankle, ball, and toe joints face toward the bones next to them *(Figure 8)*.

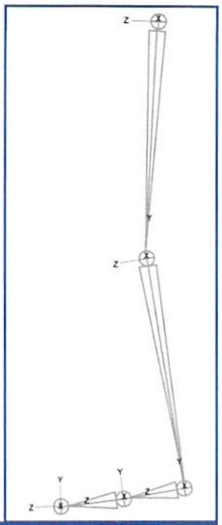


FIG. 8– STEP 5 CONTINUED. ORIENTING THE LEG JOINTS IN THE SIDE VIEW

## STEP 6

Check to make sure the spine is in the middle of the figure. Connect the "hip" joint to the "spine1" joint by doing the following. Set up your panels so that you can see the Outliner and Perspective views. In the Outliner, locate the joint named "hip." Middle-click/drag it in the Outliner to drop it directly on the joint named "spine1." The perspective view should now show them connected with a new bone (Figure 9).

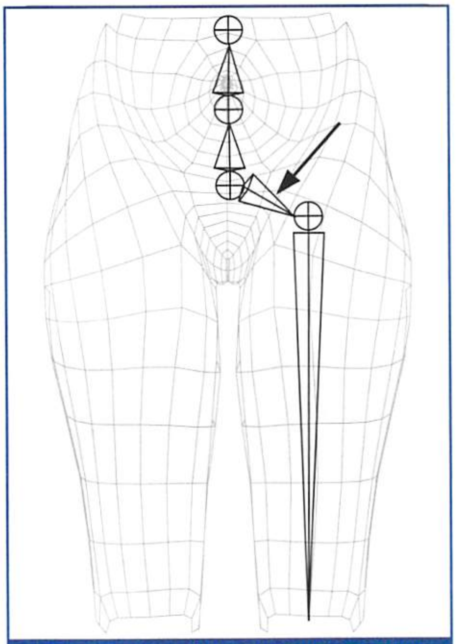


FIG. 9– STEP 6, CONNECTING THE "HIP" JOINT TO THE "SPINE1" JOINT BY MIDDLE CLICK-DRAGGING IN THE OUTLINER

## STEP 7

The next step involves making the arm and hand joints. Switch to the top view and select the Joint tool. Starting at the left shoulder, create a series of joints similar to the ones shown in Figure 10. The last joint is at the end of the middle finger.

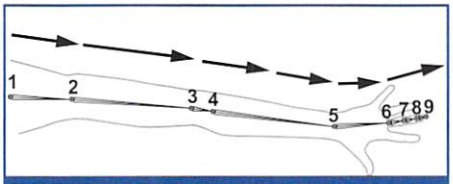


FIG. 10– STEP 7, CREATING THE SHOULDER, ARM AND MIDDLE FINGER JOINTS IN THE TOP VIEW

Make the pinky, ring finger, index, and thumb joints. Create these groups separately. When you finish one finger, click or select the Joint tool again to start a new set of joints for the next finger. Refer to Figure 11.

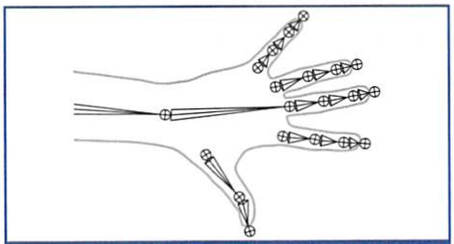


FIG. 11– STEP 7 CONTINUED, MAKING THE REST OF THE FINGERS AND THUMB

The pinky, ring, index fingers, and the thumb will now be connected to the wrist joint. Select the base joint of the pinky finger and Shift-select the wrist joint. Press "p" or go to *Edit > Parent* to parent the two joints. This will create another bone connecting the two joints. Select the base joint of the ring finger and Shift-select the wrist joint. Press "p" to parent these two. Parent the index finger and thumb to the wrist joint. Your hand bones should now look somewhat like the ones in Figure 12.

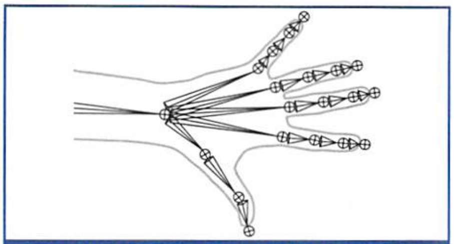


FIG. 12– STEP 7 CONTINUED, CONNECTING THE BASE JOINT OF THE FINGERS AND THUMB TO THE WRIST JOINT BY PARENTING THEM. NOTE THE NEW CONNECTING BONES THAT EXTEND FROM THE WRIST JOINT TO ALL THE FINGERS AND THE THUMB

Use your front and/or side views to move the entire arm and hand skeleton up so that it is inside the arm of your model. Adjust the hand and finger joints by moving and rotating them until each is inside your character's hand.

## STEP 8

Select the base joint of the arm bone at the shoulder. Shift-select the joint named "spine6." Press "p" to parent so that you now have a shoulder bone similar to the one shown in Figure 13.

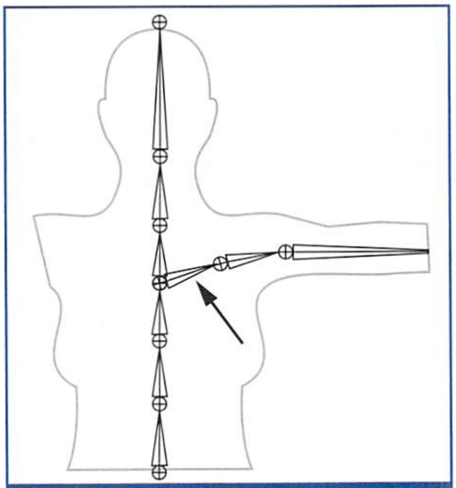
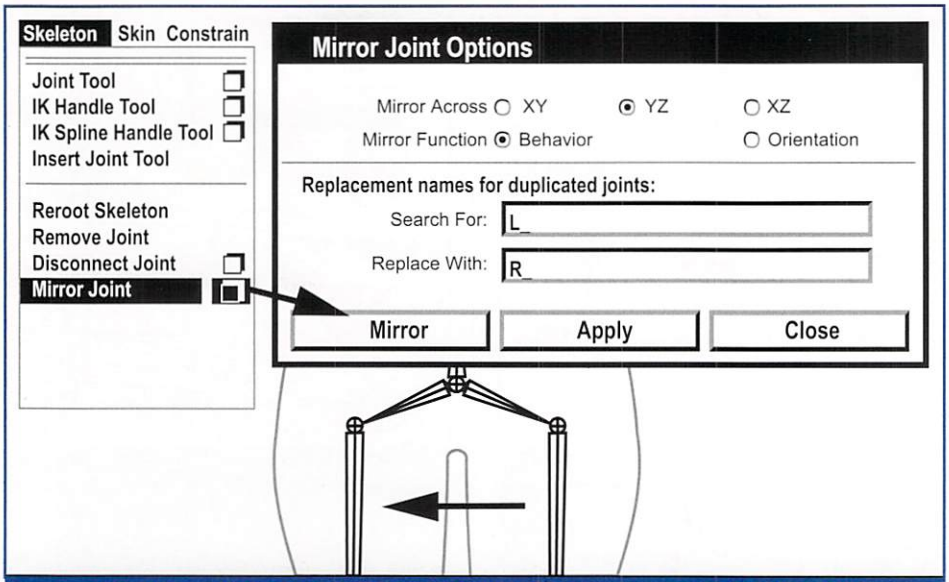


FIG. 13– STEP 8, THE UPPER ARM JOINT IS CONNECTED TO THE "SPINE6" JOINT CREATING A SHOULDER BONE

**THERE ARE MANY WAYS OF RIGGING AND IT IS UP TO EACH ANIMATOR TO FIND THE ONE THEY PREFER**



**Mirror Joint Options**

Mirror Across ○ XY ● YZ ○ XZ

Mirror Function ● Behavior ○ Orientation

Replacement names for duplicated joints:

Search For: L_

Replace With: R_

FIG. 14– STEP 9, MIRRORING THE LEFT LEG JOINTS TO MAKE THE RIGHT LEG SKELETON

## STEP 9

Click on the hip joint and go to *Skeleton > Mirror Joint > Options.* In the Mirror Joint Options box, for Mirror Across, select the YZ-axes. Next to "Search For:" type L_. For "Replace With:" type R_. Click the Mirror button. You should now have a skeleton for the right leg that is connected to the "spine1" joint *(Figure 14).*

## STEP 10

The local rotation axes of the hand and arm should be adjusted. In order to test the way the fingers curl, use the Mel script "select –hi." You should already have a shelf button for this if you started with last issue's tutorial "Setting Up the Human Model for Animation" (check under the heading Selecting a Skeleton's Hierarchy with a Mel Script).

Click on the base joint of each finger, click the "select -hi" shelf button, and rotate the joint to make the fingers curl into a closed position. If the fingers rotate in the right direction, then you will not have to make any adjustments to the local rotation axes.

To adjust all the joints' rotation axes, follow the steps in "Setting Up the Human Model for Animation" under the heading Toggling Local Rotation Axes. The Y-axis should point straight up, the X-axis should point toward the next bone, and the Z-axis should stick out to the side. Toggle back and forth between Object and Component mode (F8) using "select -hi" to test each fingers rotation. For the thumb, have the Y-axis point up and the X-axis to the outside at about a 45-degree angle. This will slant the thumb toward the palm when it is curled in. Figure 15 shows the joints and rotation axes of the thumb and index finger.

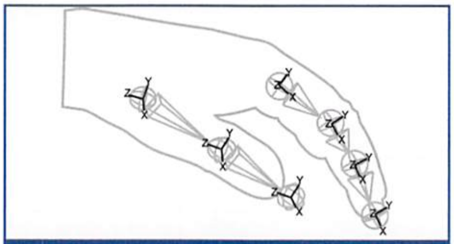


FIG. 15– STEP 10, ADJUSTING THE LOCAL ROTATION AXES OF THE THUMB AND INDEX FINGER

Adjust the local rotation axes of the wrist joint so that the Y-axis points up, the X-axis points toward the middle finger and the Z-axis points to the side. Adjust the rotation axes for the upper and lower arm joints. The Y-axis should point straight up, the X-axis has its direction toward the bone next to it, and the Z-axis points toward the side.

## STEP 11

Name the arm, finger, and thumb joints:

L_Shoulder
L_UprArm
L_LwrArm1
L_LwrArm2
L_Wrist
L_Thumb
L_ThumbTip
L_IndexFinger
L_IndexFingerMiddle
L_IndexFingerTip
L_MiddleFinger
L_MiddleFingerMiddle
L_MiddleFingerTip
L_RingFinger
L_RingFingerMiddle
L_RingFingerTip
L_PinkyFinger
L_PinkyFingerMiddle
L_PinkyFingerTip

## STEP 12

Select the "L_Shoulder" joint and go to *Skeleton > Mirror Joint > Options.* In the Mirror Joint Options box, for Mirror Across, select the YZ axes. Next to "Search For:" type L_. For "Replace With:" type R_. Click the Mirror button *(Figure 14).* The arm should mirror across the X-axis and automatically connect to the "spine6" joint.

## STEP 13

The next steps will take you through making IK handles and building a reverse foot control. Go to *Skeleton > IK Handle Tool > Options.* In the options window under IK Handle Settings, next to Current Solver, make sure that you have "ikRPsolver" selected. Using the IK Handle tool, click on the "hip" joint and then the "ankle" joint. You should now have an IK handle at the ankle that can be moved up and down to bend and move the leg. Repeat these steps on the other leg.

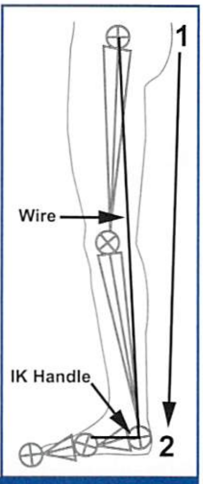


FIG. 16– STEP 13, USING THE IK HANDLE TOOL ON THE HIP AND ANKLE JOINTS

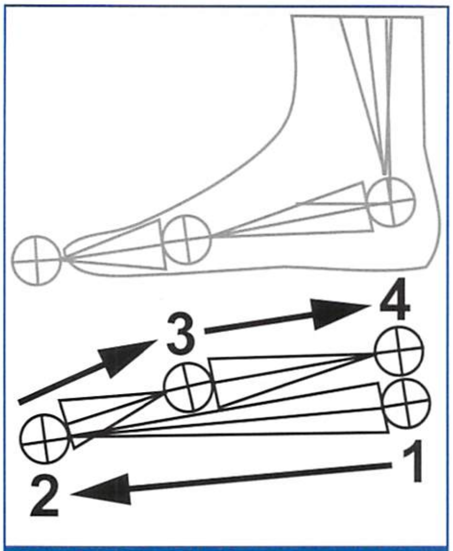


FIG. 17– STEP 13, BUILDING A REVERSE FOOT CONTROL. CREATING THE "HEELCONTROL" JOINT (1), THE "TOECONTROL" JOINT (2), THE "BALLCONTROL" JOINT (3), AND THE "ANKLECONTROL" JOINT (4).

When animating the legs, it's important to have the foot bend at the toes. One could create another IK Handle, but there is a more efficient method that uses a reverse foot control. In the side view, zoom in on the foot. Select the Joint tool and click once below the ankle, then again below the toe joints, then back again below the ball joint, and finally below the ankle control *(Figure 17).*

Rename the first joint "HeelControl," the second joint "ToeControl," the third joint "BallControl," and the fourth joint "AnkleControl." Using the top or front views, move the reverse foot control under the left foot. Copy and paste the reverse foot control and place it under the right foot.

## STEP 14

Select the "AnkleControl" joint on the left reverse foot control. Shift-select the left leg's IK Handle located at the ankle. Go to *Constrain > Point (Figure 18).* Now when you select the "Heel Control" of the reverse foot control and move it around the leg also moves.

The next part is to set up some constraints for controlling the orientation of the foot. Select the "BallControl" joint on the reverse foot constraint. Shift-select the anklebone of the foot skeleton and choose *Constrain > Orient (Figure 19).*

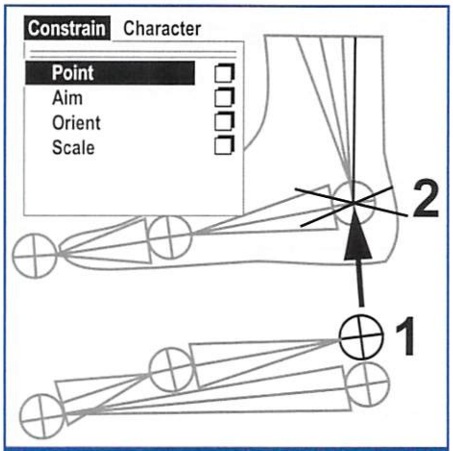


FIG. 18 STEP 14. AFTER CLICKING ON THE "ANKLE-CONTROL" (1), THE IK HANDLE IS SHIFT SELECTED (2). CHOOSING *CONSTRAIN > POINT* CONNECTS THE IK HANDLE TO THE REVERSE FOOT CONTROL

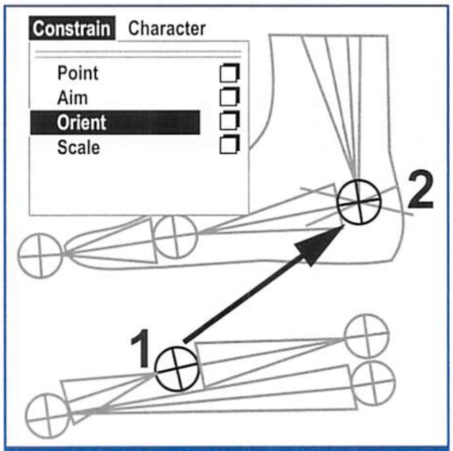


FIG. 19– STEP 14 CONTINUED, AFTER CLICKING ON THE "BALLCONTROL" (1), THE ANKLE JOINT IS SHIFT SELECTED (2). CHOOSING *CONSTRAIN > ORIENT* CONNECTS THE ROTATION OF THE ANKLE JOINT TO THE REVERSE FOOT CONTROL

Select the "ToeControl" joint on the reverse foot constraint. Shift -select the ball joint of the foot skeleton and choose *Constraint > Orient (Figure 20).*

Now all the rotations are connected to the reverse foot control. If you try rotating the "BallControl" joint or the "ToeControl" joint on the reverse foot constraint, they will in turn rotate the ball and toe joints on the foot skeleton.

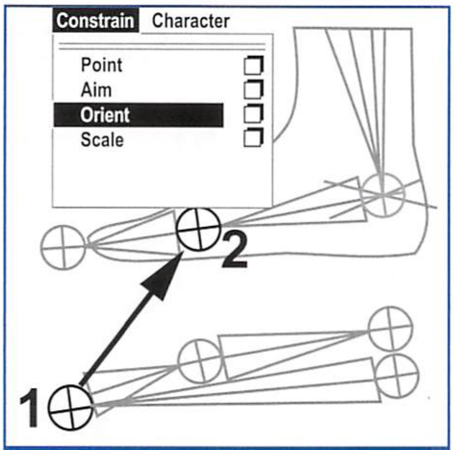


FIG. 20– STEP 14 CONTINUED, AFTER CLICKING ON THE "TOECONTROL" (1), THE BALL JOINT IS SHIFT SELECTED (2). CHOOSING *CONSTRAIN > ORIENT* CONNECTS THE ROTATION OF THE BALL JOINT TO THE REVERSE FOOT CONTROL

Before you start repeating the procedure outlined under Step 13 for the other foot, you will need to correct the right reverse foot control joints' orientation (Figure 21). The Y-axis should point up. Note that the orientation of the local rotation axis of both legs should have the X-axis pointing in opposite directions – toward the outside of the legs. If you do not fix the local rotation axes on the right reverse foot control, the right foot will spin around and point in the wrong direction when you choose *Constraint > Orient.* Basically, the local orientation axes of the reverse foot control have to be the same as the ones on its corresponding foot joints.

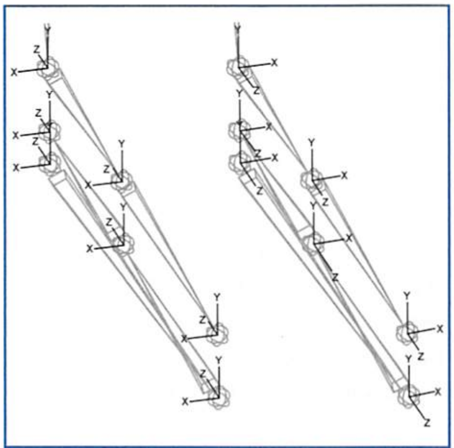


FIG. 21– STEP 14 CONTINUED, CORRECTING THE LOCAL ROTATION AXES OF THE DUPLICATE REVERSE FOOT CONTROL. THEY SHOULD ALL POINT IN THE SAME DIRECTION AS THE FOOT ABOVE IT

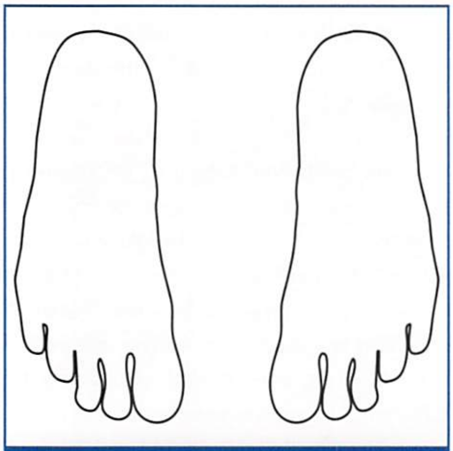


FIG. 22– STEP 15, CREATING FOOT ICONS IN THE TOP VIEW USING THE EP CURVE TOOL

## STEP 15

Instead of trying to find the different joints to control the feet during an animation, it is easier to set up a foot control. This control will be made in the form of a foot icon. Switch to the top view and go to *Create > EP Curve Tool.* Draw the outlines of a foot *(Figure 22).* Go to the Modeling Menu Set and select *Edit Curves > Open/Close Curves.* This will enclose the outline. Scale it and move it behind one of the feet.

## STEP 16

Before creating Set Driven Keys to control the feet, some things should be put in order. Delete the history for the foot icon *(Edit > Delete by Type > History).* Go to *Modify > Freeze Transformation.* This will reset the Translation to 0 and Scale to 1 in the Channel box. Duplicate the foot outline (Control d), go to the Channel box, and change the Scale X to -1 so that the foot icon is mirrored. Move it next to the original foot icon. Delete its history and freeze its transformation, also. In the Channel box, rename the two curves "L_FootIcon" and "R_FootIcon." The advantage to using curves is that they will not render. Select each foot icon and then go to *Modify > Center Pivot.* Your feet icons should now look and be in a similar spot, like the ones in Figure 23.

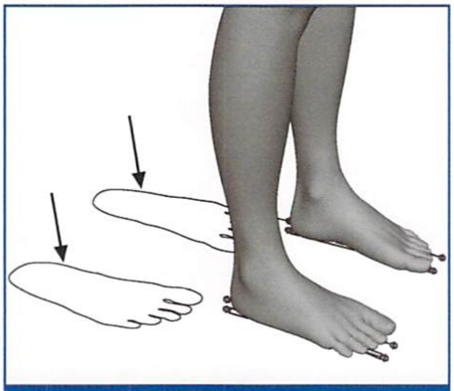


FIG. 23– STEP 16, SCALING AND PLACING THE FOOT ICONS BEHIND THE CHARACTER

In the Channel box for each foot icon there are some attributes, such as Scale and Visibility, that will not be needed. Therefore, they will now be eliminated through the Channel Control option box. Select one of the foot icon curves, go to Window > General Editors > Channel Control *(Figure 24).* In the Channel Control option box, select all the scale and the visibility attributes under the heading Keyable. Click the Move >> button on the bottom and close the box *(Figure 25).* Notice how the Channel box no longer shows the scale and visibility attributes for the foot icon. Select the other foot icon and do the same thing to it.

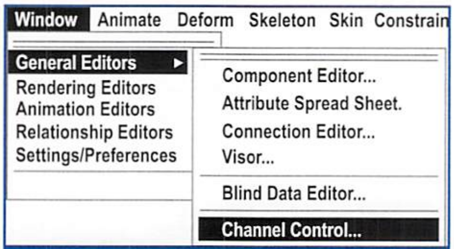

Window
Animate
Deform
Skeleton
Skin
Constrain
General Editors
Rendering Editors
Animation Editors
Relationship Editors
Settings/Preferences
Component Editor...
Attribute Spread Sheet.
Connection Editor...
Visor...
Blind Data Editor...
Channel Control...

FIG. 24– STEP 16 CONTINUED. OPENING THE CHANNEL CONTROL BOX IN ORDER TO ELIMINATE NONESSENTIAL ATTRIBUTES IN THE CHANNEL BOX

## STEP 17

A roll attribute will now be added to the foot icons in the Channel box. Select the left foot icon and go to *Modify > Add Attribute... (Figure 26).* In the Add Attribute box, fill in the same values as shown in Figure 27 (Next page). The Attribute name is "footRoll." Under Numeric Attribute Properties, next to Minimum, type -5. This designates the foot will be angled back on its heels with the toes pointing up in the air. Maximum should be set to 10 so that the foot will be on its toes with the heel up in the air. A value of 5 will mean that the foot is bent at the ball joint. The Default of 0 signifies there is no foot roll. Notice how the Channel box shows the new attribute "footRoll."

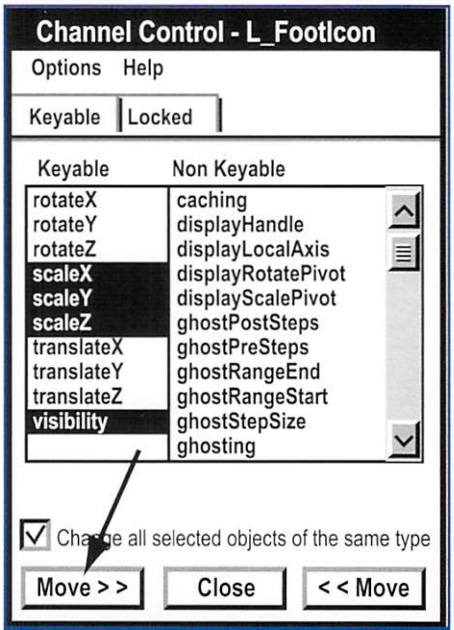

Channel Control - L_FootIcon
Options
Help
Keyable
Locked
Keyable
Non Keyable
rotateX
rotateY
rotateZ
scaleX
scaleY
scaleZ
translateX
translateY
translateZ
visibility
caching
displayHandle
displayLocalAxis
displayRotatePivot
displayScalePivot
ghostPostSteps
ghostPreSteps
ghostRangeEnd
ghostRangeStart
ghostStepSize
ghosting
☑ Change all selected objects of the same type
Move >>
Close
<< Move

FIG. 25– STEP 16 CONTINUED, SELECTING THE SCALE AND VISIBILITY ATTRIBUTES IN THE CHANNEL CONTROL. CLICKING THE MOVE>> BUTTON MOVES THEM OUT OF THE CHANNEL BOX

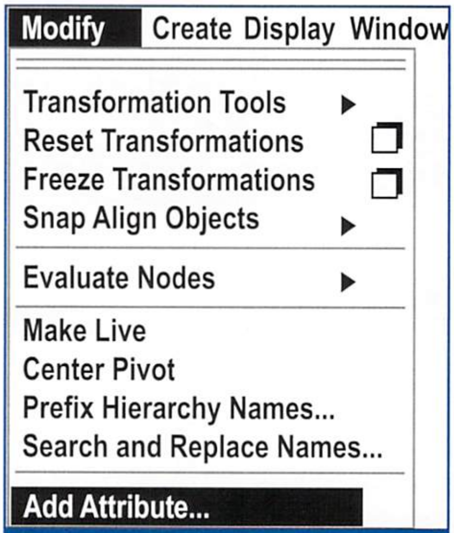
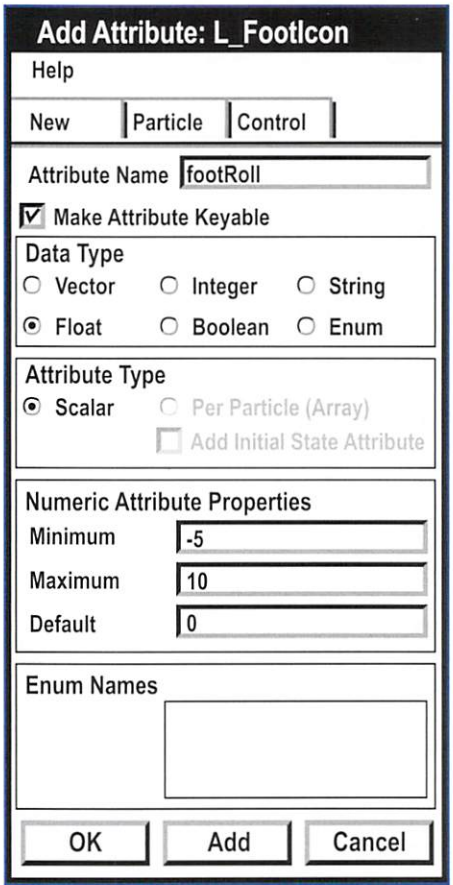

Modify
Create
Display
Window
Transformation Tools
Reset Transformations
Freeze Transformations
Snap Align Objects
Evaluate Nodes
Make Live
Center Pivot
Prefix Hierarchy Names...
Search and Replace Names...
Add Attribute...

FIG. 26– STEP 17, OPENING THE ATTRIBUTE BOX FOR ADDING CERTAIN PROPERTIES TO THE CHANNEL BOX


Add Attribute: L_FootIcon
Help
New
Particle
Control
OK
Add
Cancel

Attribute Name: footRoll

☑ Make Attribute Keyable

Data Type

○ Vector ○ Integer ○ String

● Float ○ Boolean ○ Enum

Attribute Type

● Scalar ○ Per Particle (Array)

☐ Add Initial State Attribute

Numeric Attribute Properties

Minimum: -5

Maximum: 10

Default: 0

Enum Names

FIG. 27– STEP 17 CONTINUED. IN THE ADD ATTRIBUTE BOX, SET THE FOOTROLL TO A MINIMUM -5 (THE FOOT IS ANGLED BACK), MAXIMUM 10 (THE FOOT IS ANGLED FORWARD)

## STEP 18

A Set Driven Key will be prepared so that we can control the roll of the foot through the Channel box. Select the left foot curve and go to *Animate > Set Driven Keys > Set > Options (Figure 28).* In the Set Driven Key option box click the Load Driver button. This will load the "L_FootIcon" as the driver. The second column shows the "footRoll" attribute that will drive the reverse foot control that, in turn, controls the foot and leg rig. Select that also.

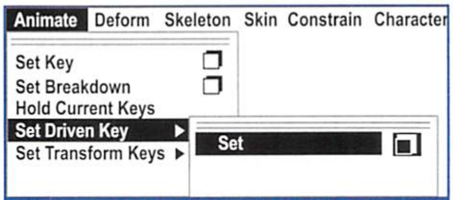

Animate
Deform
Skeleton
Skin
Constrain
Character
Set Key ☐
Set Breakdown ☐
Hold Current Keys
Set Driven Key ▶
Set Transform Keys ▶
Set ☐

FIG. 28– STEP 18 GOING TO THE SET DRIVEN KEYS OPTION BOX

Keeping the Set Driven Key box open, select the root joint of the left foot reverse foot control (the heel joint). This will select the entire reverse foot control.

If you do not have a shelf button for the Mel script "select -hi," then go ahead and make one while the Set Driven Key window is open. Click the shelf button with the "select -hi" Mel script. This will select all the joints of the hierarchy so that you can load them altogether into the Set Driven Key box.

The entire reverse foot control should now be selected. In the Set Driven Key option box, click the Load Driven button. This loads every joint of the reverse foot control under the Driven category.

Under the Driven heading, Shift-select only the Heel, Toe, and Ball controls. We will not have to do anything with the Ankle control. Click the Driven button again and this will eliminate the Ankle control, leaving only the Heel, Toe, and Ball controls *(Figure 29).*

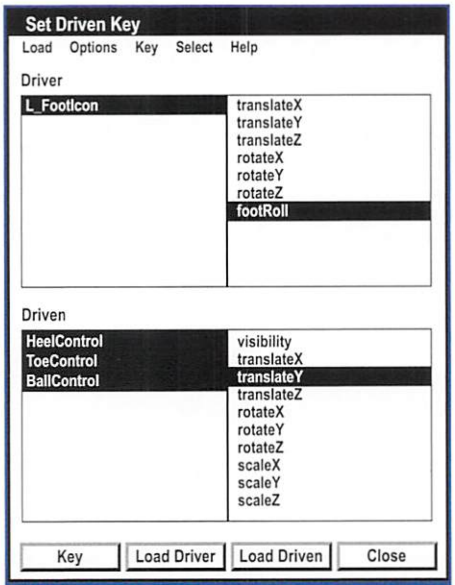

Set Driven Key
Load
Options
Key
Select
Help
Driver
L_FootIcon
translateX
translateY
translateZ
rotateX
rotateY
rotateZ
footRoll
Driven
HeelControl
ToeControl
BallControl
visibility
translateX
translateY
translateZ
rotateX
rotateY
rotateZ
scaleX
scaleY
scaleZ
Key
Load Driver
Load Driven
Close

FIG. 29 STEP 18 CONTINUED. USING THE SET DRIVEN KEY OPTION BOX TO SET UP THE LEFT FOOT CONTROL

Select only the Heel control under the Driven heading. Rotate it up so that the heel is down while the toes point up. Look in the Channel box to see which axis shows a numerical change. This is the axis that will have to be keyed later. Undo the rotation so that all rotational axes for the heel joint are back to 0,

In the Set Driven Key box, on the right column, click on the name of the axis that showed a rotation change when you rotated the heel so that the toes pointed up. In my example, it was the "rotateX" axis. This is the axis that will be referred to from now on, even though yours may be different. The reason your rotational axis is different is because the rotational axes on your foot control were not set to point in the same direction as the ones in Figure 21. Press the Key button on the bottom left of the Set Driven Key box.

While keeping the Set Driven Key box open, click on the left foot curve to select it. In the Channel box, next to "footRoll" type in -5.

In the Set Driven Key box, under the name Driven, select the Heel control. Rotate it up about 20 degrees on the X-axis so that the heel is down while the toes point up. Press the Key button on the bottom left of the Set Driven Key box.

Test it out to see how the foot lifts by selecting the left foot curve. In the Channel box, click on the attribute named "footRoll." Hold down the middle mouse button and click and drag left and right in one of the view windows. The foot should rotate up and down. At the -5 setting in the Channel box, the foot is at its extreme up angle. At the 0 setting, it is flat on the ground. In the Channel Box, set the "footRoll" back to 0.

In the Set Driven Key box, select the Ball control. RotateX in the right column should still be selected. Click the Key button.

Under the Driver heading, click the "L_FootIcon" name that will select the left foot curve. In the Channel box, change the "footRoll" attribute to 5.

In the Set Driven Key box, under the name Driven, select the Ball control name again. Rotate it about 35 degrees up on X-axis so that the heel of the foot is up in the air while the toes are flat on the ground and the foot bends at the ball joint. (Note: if you are working on the right foot, the right foot Ball control is rotated -35 degrees.) Click the Key button.

In the Set Driven Key box, under the name Driven, select the Toe control name. Click the Key button.

Under Driver, in the Set Driven Key box, select the "L_FootIcon" name. In the Channel box, next to "footRoll" type in 10.

Select the Toe control name under Driven. Rotate the Toe control up about 40 degrees on the X-axis so that the toes point straight down while the heel is up in the air. (Note: if you are working on the right foot, the right foot Toe control is rotated -40 degrees.) Click the Key button and close the Set Driven Key box.

Now you can test the foot roll. Select the left foot curve. In the Channel box, click on the attribute named "footRoll." Hold down the middle mouse button and click and drag left and right in one of the view windows. The foot and leg skeleton should now have the ability to rotate the foot up and down. At -5 "footRoll" the heel is on the ground and the toes point straight up. At 0 the foot is flat on the ground. When the setting is at 5 the heel is up while the toes remain flat on the ground. A setting of 10 makes the heel rise up higher with only the tips of the toes touching the ground. In the Channel box, set the "footRoll" back to 0.

Repeat all the steps outlined in Steps 17 and 18 for the right foot control.

## STEP 19

The two foot controls (foot icon curves) should now be set up to control the heel joints for raising and lowering the legs. Bring up the Outliner/Perspective windows. Select the left Heel control joint ("L_HeelControl"). This will select your entire left reverse foot rig. Middle-click its name in the Outliner and drag it on top of the left foot curve ("L_FootIcon"). Test it out by selecting the left foot curve ("L_FootIcon") and move it up and down. This will move the reverse foot control, which in turn makes the foot and leg rig go up and down.

Repeat these steps for the right leg. The two foot icon curves are the ones used to control the movement and rotation of the feet and legs and are the ones that are keyframed during an animation.

## STEP 20

Even though most of the leg movements are now taken care of, occasionally you may need to control the direction that the knee points toward. A pole vector constraint will be used to accomplish this. Polygon primitive objects are going to be made that will control the knee joints.

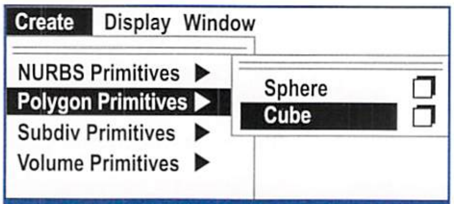


FIG. 30– STEP 20, MAKING A PRIMITIVE FOR USE AS A POLE VECTOR

Go to *Create > Polygon Primitives > Cube (Figure 30).* Scale it down so that it is about twice the size of the knee joint. Place it in front of the left hip joint ("l_hip"). Delete its history *(Edit > Delete by Type > History).* Freeze the cube's transformation by going to *Modify > Freeze Transformations.*

While the cube is still selected, hold down the Shift key and select the left leg skeleton's IK Handle. Go to *Constrain > Pole Vector (Figure 31).* This will draw a line from the left hip joint to the cube. Now when you move the cube, the knee will point toward whichever direction you desire. Name the cube "L_KneePointer."

Since we do not want the cube to render, select it and open up its Attribute Editor. Under Render Stats, turn off all the options. The cube will no longer show up during rendering.

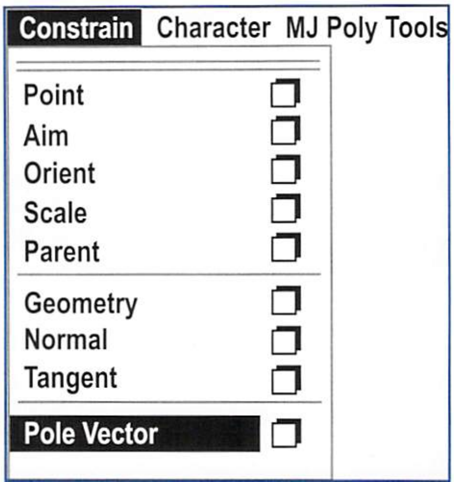


FIG. 31– STEP 20 CONTINUED, CREATING A POLE VECTOR TO CONTROL THE KNEE

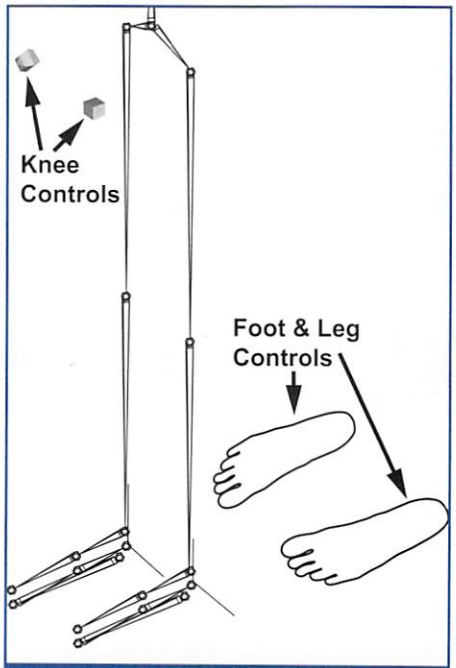


FIG. 32– STEP 20 CONTINUED, THE COMPLETED LEG RIG WITH ITS CONTROLS

Repeat everything under Step 20 for the other knee. This time use a polygon primitive sphere and name it "R_KneePointer." Figure 32 depicts all the foot, leg, and knee controls.

## STEP 21

This time, the arm controls are going to be rigged. Select the "L_UprArm" joint. Using the IK Handle tool, click on this joint, and then click on the "L_Wrist" joint *(Figure 33).* You can now bend the arm by moving the IK Handle. The Shoulder joint is rotated with Forward Kinematics. An icon can drive

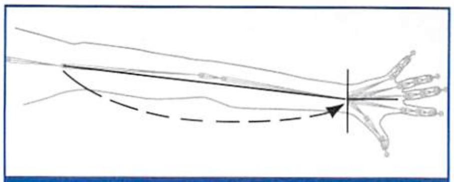


FIG. 33– STEP 21, USING THE IK HANDLE TOOL ON THE UPPER ARM AND WRIST JOINTS. NOTICE THE SHOULDER JOINT IS NOT PART OF THE IK CHAIN

each for the up, forward, and back shrug. It can also be rotated down to make the shoulders less wide. With IK you have to reach some kind of compromise. If the shoulder joint was part of the IK chain it would be much more difficult to control the motion of the arm. The reason for this is that all the movements on a chain of bones become compressed into a few goal objects.

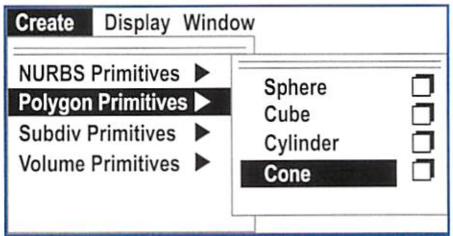

Create
Display
Window
NURBS Primitives ▶
Polygon Primitives ▶
Subdiv Primitives ▶
Volume Primitives ▶
Sphere ☐
Cube ☐
Cylinder ☐
Cone ☐

FIG. 34– STEP 21 CONTINUED, MAKING A PRIMITIVE FOR USE AS A POLE VECTOR ON THE ELBOW

In order to have more control over the position of the elbow, a pole vector will be made. Go to *Create > Polygon Primitives > Cone (Figure 34).* Scale it down to about twice the size of the elbow joint and move it behind the elbow. Name it "L_ElbowPointer." Delete its history *(Edit > Delete by Type > History).* Freeze the cone's transformation by going to *Modify > Freeze Transformations.* The cone should be set not to render. Therefore, open up its Attribute Editor and under Render Stats, turn off all the options.

While the cone is still selected, press the Shift key down and select the left arm's IK Handle. Go to *Constrain > Pole Vector (Figure 35*). Test the rotation of the arm by moving the cone up and down. The arm should turn around its X-axis.

Repeat Step 21 for the other arm. You can use a polygon primitive torus for the right elbow control. The next step will show how to create a control for the hand.

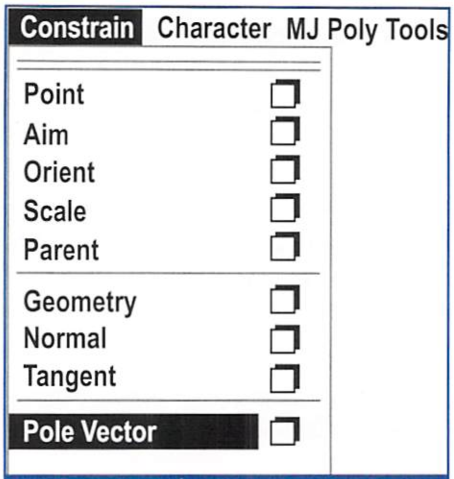

Constrain
Character
MJ Poly Tools
Point ☐
Aim ☐
Orient ☐
Scale ☐
Parent ☐
Geometry ☐
Normal ☐
Tangent ☐
Pole Vector ☐

FIG. 35– STEP 21 CONTINUED, CREATING A POLE VECTOR TO CONTROL THE ELBOW

## STEP 22

Switch to the front view and go to *Create > EP Curve Tool.* Draw the outlines of a hand *(Figure 36).* Go to the Modeling Menu Set and select *Edit Curves > Open/Close Curves.* This will enclose the outline. Scale it and move it behind the left hand rig. Make a duplicate of the hand curve (Control "d"), move it behind the right hand, and type -1 next to ScaleX in the Channel Editor to flip it. Name them "R_HandIcon" and "L_HandIcon." Select each hand curve and go to *Modify > Center Pivot.* While each of the hand curve icons are selected, go to *Edit > Delete By Type > History.* You should also select each hand icon and go to *Modify > Freeze Transformations* so that the Channel Editor only shows zero settings for Translate and Rotate. These properties make it easier to remember the hand icons' neutral positions.

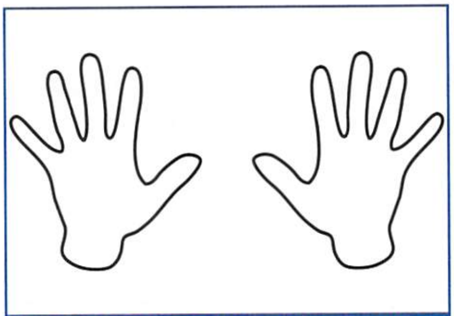


FIG. 36– STEP 22, THE HAND ICONS MADE WITH THE EP CURVE TOOL. THESE WILL CONTROL THE HAND MOVEMENTS

Select the left arm's IK Handle. Shift-select the left hand icon. Press "p" to parent them. The parent of the IK Handle is the hand icon curve, which now controls the movements of the arm. You can test the arm motions by selecting the "L_HandIcon" and moving it around.

Select the right arm's IK Handle. Shift-select the right hand curve ("R_HandIcon"). Press "p" to parent them.

## STEP 23

Now it is time to set up the fingers so that they can be curled closed using the hand icon. Select the "L_HandIcon" and go to *Window > General Editors > Channel Control... (Figure 37).* In the Channel Control option box, select all the scale and the visibility attributes under the heading Keyable. Click the Move >> button on the bottom and close the box *(Figure 38).*

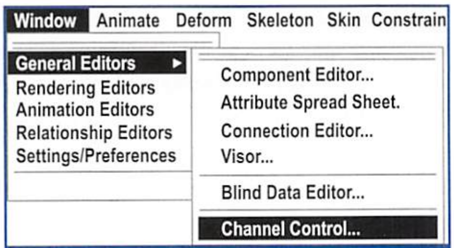

Window
Animate
Deform
Skeleton
Skin
Constrain
General Editors ▶
Rendering Editors
Animation Editors
Relationship Editors
Settings/Preferences
Component Editor...
Attribute Spread Sheet.
Connection Editor...
Visor...
Blind Data Editor...
Channel Control...

FIG. 37– STEP 23, OPENING THE CHANNEL CONTROL IN ORDER TO DELETE EXTRANEOUS CHANNEL ATTRIBUTES

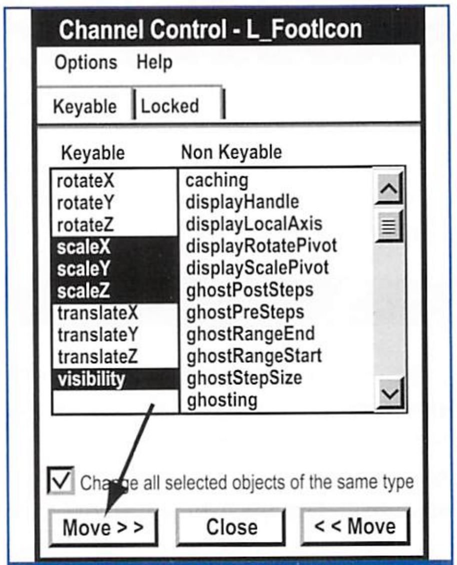

Channel Control - L_FootIcon
Options
Help
Keyable
Locked
Keyable
Non Keyable
rotateX
rotateY
rotateZ
scaleX
scaleY
scaleZ
translateX
translateY
translateZ
visibility
caching
displayHandle
displayLocalAxis
displayRotatePivot
displayScalePivot
ghostPostSteps
ghostPreSteps
ghostRangeEnd
ghostRangeStart
ghostStepSize
ghosting
☑ Change all selected objects of the same type
Move >>
Close
<< Move

FIG. 38 STEP 23 CONTINUED. SELECTING THE SCALE AND VISIBILITY ATTRIBUTES IN THE CHANNEL CONTROL. CLICKING THE MOVE>> BUTTON MOVES THEM OUT OF THE CHANNEL BOX

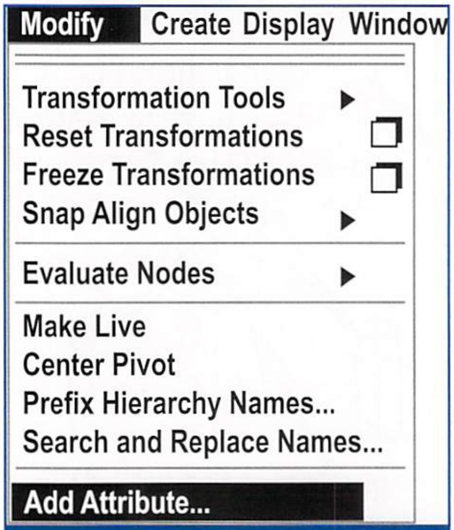
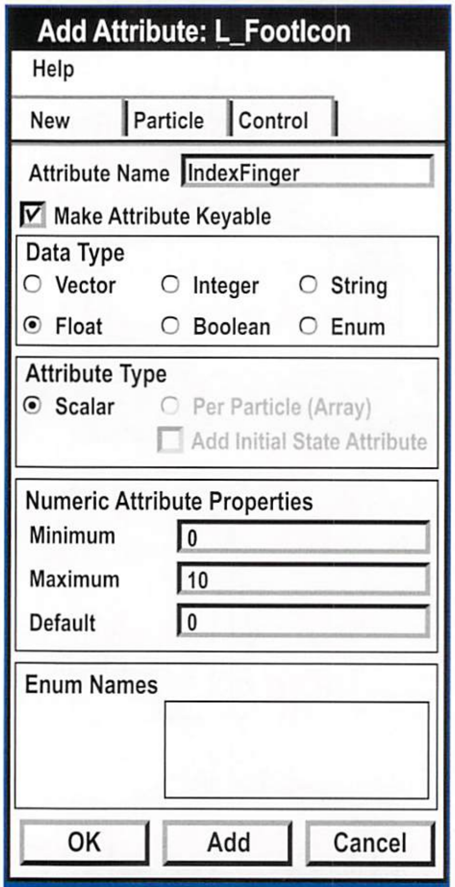

Modify
Create
Display
Window
Transformation Tools
Reset Transformations
Freeze Transformations
Snap Align Objects
Evaluate Nodes
Make Live
Center Pivot
Prefix Hierarchy Names...
Search and Replace Names...
Add Attribute...

FIG. 39– STEP 23 CONTINUED, OPENING THE ATTRIBUTE BOX FOR ADDING CERTAIN PROPERTIES TO THE CHANNEL BOX


Add Attribute: L_FootIcon
Help
New
Particle
Control
Enum Names
OK
Add
Cancel

Attribute Name: IndexFinger
☑ Make Attribute Keyable
Data Type: ○ Vector ○ Integer ○ String ● Float ○ Boolean ○ Enum
Attribute Type: ● Scalar ○ Per Particle (Array) ☐ Add Initial State Attribute
Numeric Attribute Properties
Minimum: 0
Maximum: 10
Default: 0

FIG. 40– STEP 23 CONTINUED, ADDING THE FINGER AND THUMB ATTRIBUTES TO THE CHANNEL EDITOR

While the "L_HandIcon" is still selected, go to *Modify > Add Attribute... (Figure 39)*. In the Add Attribute option box *(Figure 40)*, type "IndexFinger" next to Attribute Name. Under Numeric Attribute Properties, next to Minimum, type 0. Maximum should be set to 10. The Default is set to 0. Click Add to add the Index Finger attribute to the Channel Editor. Continuing in the Add Attribute box, type "MiddleFinger" next to Attribute Name. Under Numeric Attribute Properties, next to Minimum, type 0. For Maximum type 10. The Default is 0. Click Add to add the Middle Finger attribute to the Channel Editor and type "RingFinger" next to Attribute Name. Under Numeric Attribute Properties, next to Minimum type 0. For Maximum type 10. The Default is 0. Click Add to add the Ring Finger attribute to the Channel Editor, and type "PinkyFinger" next to Attribute Name. Under Numeric Attribute Properties next to Minimum type 0. For Maximum type 10. The Default is 0. Click Add to add the Pinky Finger attribute to the Channel Editor, and type "Thumb" next to Attribute Name. Under Numeric Attribute Properties, next to Minimum, type 0. For Maximum type 10. The Default is 0. Click Add to add the Thumb attribute to the Channel Editor. Exit the Add Attribute options.

## STEP 24

Go to *Animate > Set Driven Key > Set > Options (Figure 41)*. While the "L_HandIcon" curve is still selected, click the Load Driver button in the Set Driven Key option box *(Figure 42)*. Select the name "IndexFinger" from the right side column.

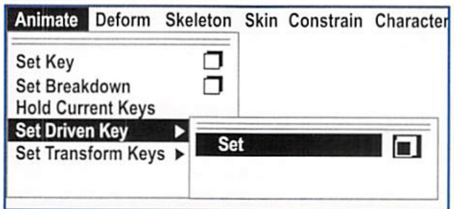

Animate
Deform
Skeleton
Skin
Constrain
Character
Set Key
Set Breakdown
Hold Current Keys
Set Driven Key
Set Transform Keys
Set

FIG. 41– STEP 24, GOING TO THE SET DRIVEN KEYS OPTION BOX

While the Set Driven Key option box is still open, select the base joint of the index finger ("L_IndexFinger"). Click the shelf button with the "select -hi" Mel script. This will select all the joints of the index finger hierarchy so that you can load them altogether into the Set Driven Key box. Click the Load Driven button. Under the Driven heading, it should list all the index finger joints. Shift-select all of these and select

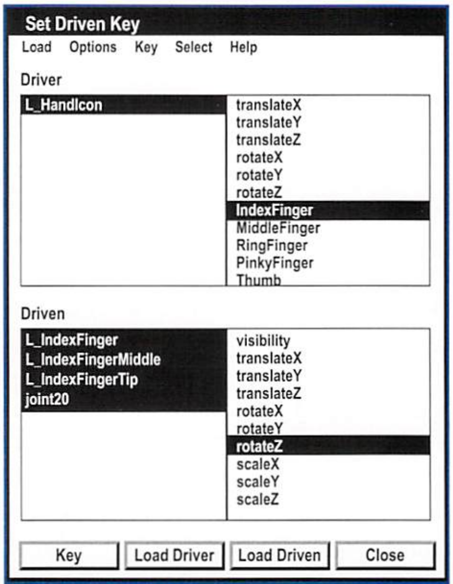

Set Driven Key
Load
Options
Key
Select
Help
Driver
L_HandIcon
translateX
translateY
translateZ
rotateX
rotateY
rotateZ
IndexFinger
MiddleFinger
RingFinger
PinkyFinger
Thumb
Driven
L_IndexFinger
L_IndexFingerMiddle
L_IndexFingerTip
joint20
visibility
translateX
translateY
translateZ
rotateX
rotateY
rotateZ
scaleX
scaleY
scaleZ
Key
Load Driver
Load Driven
Close

FIG. 42– STEP 24 CONTINUED. USING THE SET DRIVEN KEY OPTION BOX TO SET UP THE LEFT INDEX FINGER

the name "rotateZ" from the right column,. Press the Key button to key them in their neutral position.

Under Driver, click the name "L_HandIcon." In the Channel Editor, next to IndexFinger, type 10. Under Driven, Shift-select all the joints of the index finger and rotate them on the Z-axis approximately -50 degrees so that the tip of the finger almost touches the palm of the hand. Click the Key button.

Exit the Set Driven Key box. Now you can test the index finger curl. Select the left hand curve. In the Channel box, click on the attribute named "IndexFinger." Hold down the middle mouse button and click and drag left and right in one of the view windows. The index finger should curl open and closed.

Go to *Animate > Set Driven Key > Set > Options (Figure 41)*. While the "L_HandIcon" curve is still selected, click the Load Driver button in the Set Driven Key option box. On the right side column, select the name "MiddleFinger."

While the Set Driven Key option box is still open, select the base joint of the middle finger ("L_MiddleFinger"). Click the shelf button with the "select -hi" Mel script. This will select all the joints of the middle finger hierarchy so that you can load them altogether into the Set Driven Key box. Click the Load Driven button. Under the Driven heading, it should list all the middle finger joints. Shift-select all of these, and on the right column, select the name "rotateZ." Press the Key button to key them in their neutral position.

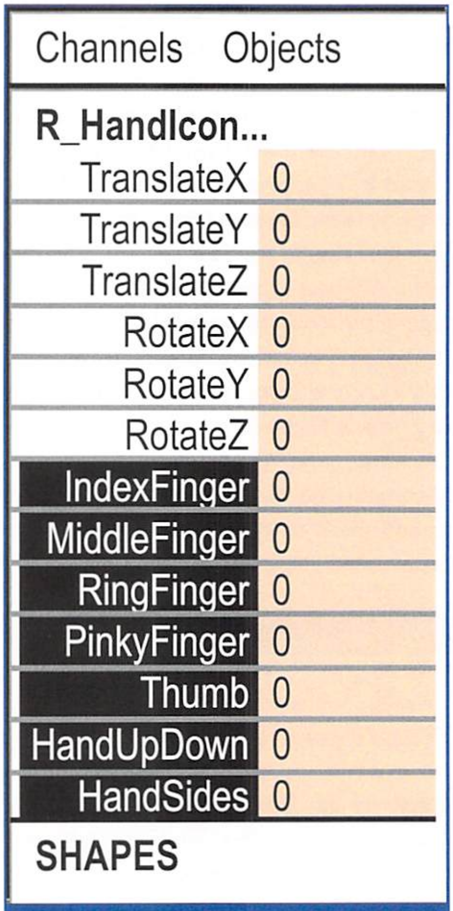
Under Driver, click the name "L_HandIcon." In the Channel Editor, next to MiddleFinger, type 10. Under Driven, Shift-select all the joints of the middle finger and rotate them on the Z-axis approximately -50 degrees so that the tip of the finger almost touches the palm of the hand. Click the Key button.

Exit the Set Driven Key box. Now you can test the middle finger curl. Select the left hand curve. In the Channel box, click on the attribute named "MiddleFinger." Hold down the middle mouse button and click and drag left and right in one of the view windows. The middle finger should curl open and closed.

Repeat all the steps listed under Step 24 for the rest of the fingers and the thumb. You will then be able to curl the fingers and thumb into a fist or curl each of them in whatever pose you need. After completing the left hand, repeat Steps 23 and 24 for the right hand.

If you find that the fingers of the rig do not fit the model as they did before using Set Driven Keys, then open the Set Driven Keys option box and load in the hand curve as the Driver and each finger's joint hierarchy as the Driven. Make sure the Driver attributes for each finger and thumb are set to 0 in the Channel Editor. Select the joints under Driven, rotate them into their correct positions inside the hand mesh and press the Key button. Repeat this procedure for each finger and thumb.

With Set Driven Keys you can also add wrist movements to the hand icon. Start by adding movements such as hand up and down and side to side to the Add Attribute box *(Figure 39)*. In the Set Driven Key box, load the hand icon as the Driver. Load the wrist joint as the Driven. Set Keys after rotating the wrist. Figure 43 shows all the attributes of the hand icon as seen in the Channel box.



Channels Objects

**R_HandIcon...**

| | |
|---|---|
| TranslateX | 0 |
| TranslateY | 0 |
| TranslateZ | 0 |
| RotateX | 0 |
| RotateY | 0 |
| RotateZ | 0 |
| IndexFinger | 0 |
| MiddleFinger | 0 |
| RingFinger | 0 |
| PinkyFinger | 0 |
| Thumb | 0 |
| HandUpDown | 0 |
| HandSides | 0 |

**SHAPES**

FIG. 43– STEP 24 CONTINUED, THE HAND ICON'S ATTRIBUTES IN THE CHANNEL BOX

## STEP 25

This time the spine will be rigged with a spline IK. You can review the previously written and illustrated information in the previous tutorial under the heading Weighting an IK Spline Handle. Figures 11 - 17 illustrate the principles that will be covered in this section.

To keep the root joint from locking down, we will build another joint below it. Switch to the side and front views. In the side view just below the root joint (the first spine joint), click with the Joint tool just once to make a single joint *(Figure 44)*. Rename the first spine joint "BaseOfSpine" and the new root joint "Root."

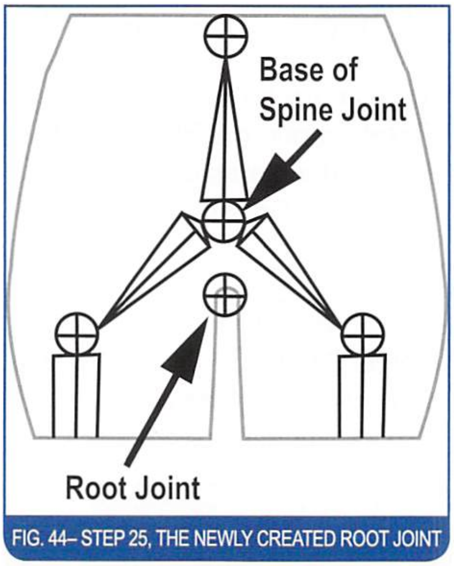


FIG. 44– STEP 25, THE NEWLY CREATED ROOT JOINT

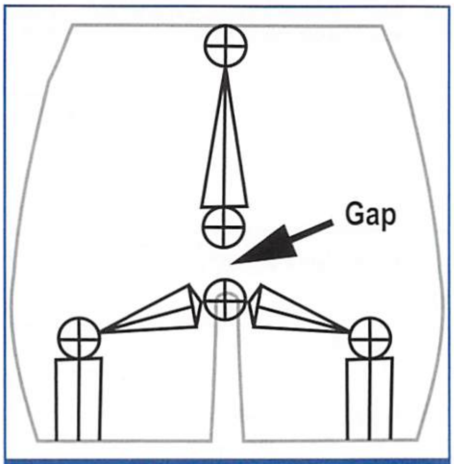


FIG. 45– STEP 25 CONTINUED, PARENTING THE HIP JOINTS TO THE NEW ROOT JOINT

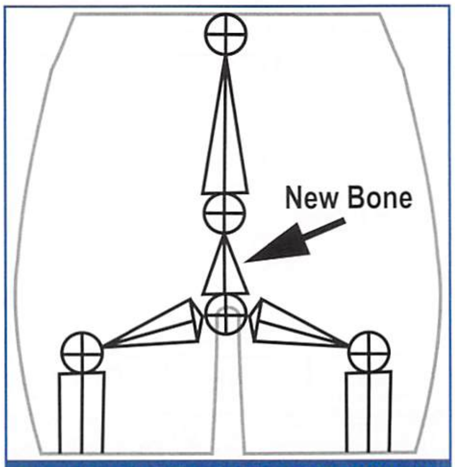


FIG. 46– STEP 25 CONTINUED, AFTER PARENTING THE BASE OF THE SPINE JOINT TO THE ROOT JOINT

Re-parent the hip joints to the new root joint. In the Outliner, select the left hip joint and middle-click/drag it on top of the one named "Root." Select the right hip joint and middle-click/drag it on top of the "Root" joint. You should now see a gap between the "Root" and the "BaseOfSpine" joints *(Figure 45)*. Now select the "BaseOfSpine" joint in the Outliner and middle-click/drag it on top of the "Root" joint. This will create a new bone between the two joints that points up *(Figure 46)*. The newly created root joint is the one that will have the spline IK added to it.

## STEP 26

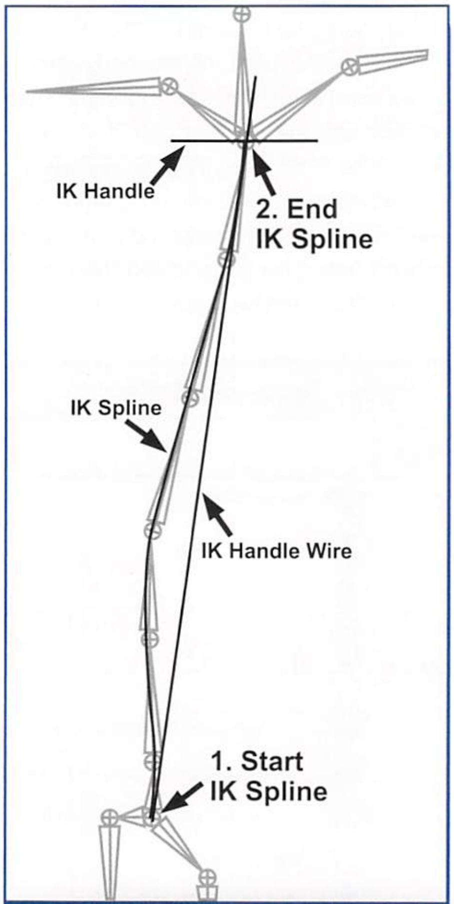


FIG. 47– STEP 26. THE NEWLY CREATED IK SPLINE FOR THE SPINE JOINTS

Select the IK Spline Handle tool by going to *Skeleton > IK Spline Handle Tool.* Click on the "Root" joint first and then click the joint named "spine6"; it is the one below the neck joint and between the two arm joints *(Figure 47)*. The spline curve that is inside the spine joints can be used to control them, but the problem is that it also moves the root joint, which should remain stationary. To fix this problem, the next step will have you weigh the control vertices along the IK spline curve. The CV at the root joint will be assigned a weight of 0 so that the root will no longer be affected. First you will need to make some Cluster Handles to control three groups of vertices.

## STEP 27

At the top of your screen, find the selection mode icon for Joints. It has the same icon as the Joint tool has. Click the button to turn it off so that you will not be able to select the joints of the spine. Click on the IK Spline to select it and go to the view window menu item Show. Under Show, select *Isolate Select > View Selected.* This will hide everything except the selected IK spline curve.

Press F8 so that you can select the spline's vertices with component type. Draw a selection around all the components in your side view. You should now see the control vertices along the spline highlighted. Select the bottom three vertices and go to *Deform > Create Cluster.* This will give you a Cluster Handle that will move the IK Spline and its hidden skeleton. You will not see it until you go to *Show > Isolated Select > View Selected.* Select the next two vertices and go to *Deform > Create Cluster.* Select the top vertex and go to *Deform > Create Cluster.* You should now have three Cluster Handles along the spine that can control the way it bends *(Figure 48)*. The next step will show how to get the base of the spine to remain stationary while the rest of the spine can be moved.

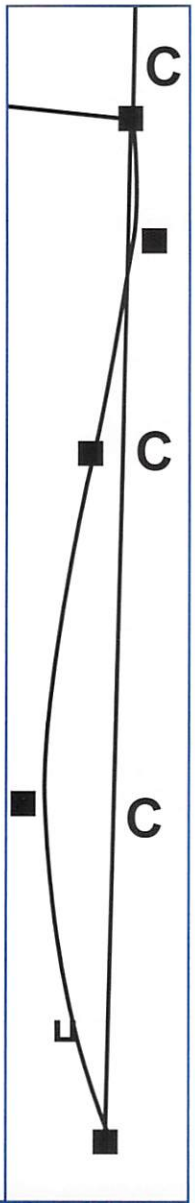
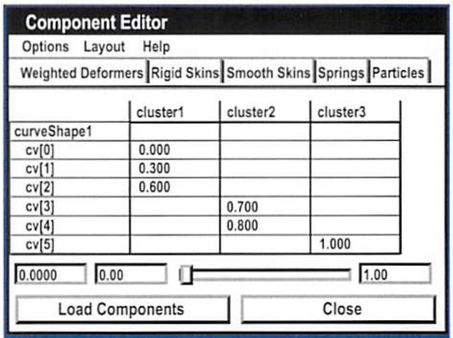


FIG. 48– STEP 27, THE IK SPLINE CONTROL VERTICES, THE THREE CLUSTER HANDLES, THE IK SPLINE, AND THE IK HANDLE WITH ITS WIRE

## STEP 28



| | cluster1 | cluster2 | cluster3 |
|---|---|---|---|
| curveShape1 | | | |
| cv[0] | 0.000 | | |
| cv[1] | 0.300 | | |
| cv[2] | 0.600 | | |
| cv[3] | | 0.700 | |
| cv[4] | | 0.800 | |
| cv[5] | | | 1.000 |

0.0000 0.00 1.00

FIG. 49– STEP 28, IN THE COMPONENT EDITOR, FOR EACH CONTROL VERTICES, USE THE SETTINGS SHOWN HERE TO GIVE EACH C A DIFFERENT WEIGHT

Select all the control vertices of the spline curve and go to *Window > General Editors > Component Editor...* Figure 49 shows the three Cluster Handles listed under the Weighted Deformers tab. Type the same value into the Component Editor as the ones listed in Figure 46. Close the Component Editor.

## STEP 29

Press F8 to get out of component type and back to object type. Bring up the Perspective and Outliner windows. Rename the Cluster Handles. Change "cluster1Handle" to "SpineBase." Make "cluster2Handle" into "SpineMiddle." Rename "cluster3Handle" "SpineTop."

Test the three Cluster Handles by moving them around to see the way the spine bends. You can always go back to *Windows > General Editors > Component Editor...* to change the weights of the vertices. Twisting the shoulders back and forth is done with the IK Handle at the top of the spine.

When you are finished testing the spline, it is very important that you undo any movements so that your rig still fits into the character.

## STEP 30

Sometimes the Cluster Handles are difficult to select. To fix this problem, select one of the Cluster Handles and go to *Display > Component Display > Selection Handles.* This will put a small plus sign on the "C" Cluster Handle. Press F8 to go into component type and click the + sign (Selection Handles Component) at the top of the screen. Turn off all the other component types. This will make it easier to select the cluster + handle. Draw a selection around the selection handle. Move it behind the "C" Cluster Handle so it will be easy to find and select. Repeat these steps to make selection handles for the other two Cluster Handles *(Figure 50).*

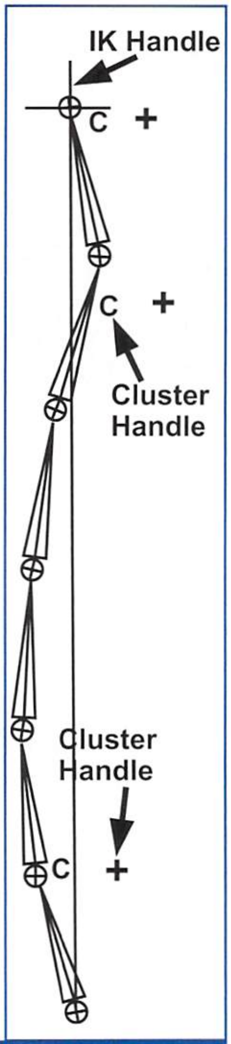


FIG. 50– STEP 30. THE THREE SELECTION HANDLES (+ SIGNS) FOR MOVING EACH OF THE CLUSTER HANDLES

## STEP 31

You probably noticed that when you moved the Cluster Handles to bend the skeleton the arms remained unaffected and stayed behind. This needs to be fixed. Select the left hand icon curve. Shift-select the "spine6" joint. This is the joint that has the Spline IK Handle in it. The two arm bones branch from this joint. Press "p" so that the "L_HandIcon" becomes parented to "spine6" – "spine6" is the parent and "L_HandIcon" is the child. Repeat this step with the other hand icon. Now, when you move the Cluster Handles, the arms also move *(Figure 51).*

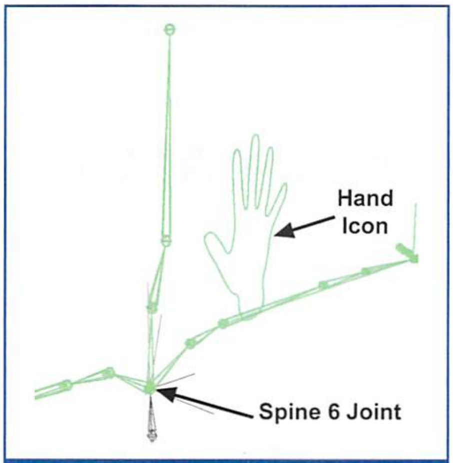


FIG. 51– STEP 31, PARENTING THE HAND ICONS TO THE SPINE 6 JOINT

In the Outliner window, select the root joint. Press Control "g" to group everything. Name the group "Master." Continuing in the Outliner window, select the "L_KneePointer" primitive (cube), the "R_KneePointer" primitive (sphere), the "L_FootIcon" curve, the "R_FootIcon" curve, and the spline curve inside the spine. Drag each of them on top of the group named "Master." This will put them inside the "Master" group so that when you select the "Master," all the parts of the character will move with it.

Another icon will be made to control the overall movements of the character. In your side view, behind your character's back, use the CV Curve tool to draw the outlines of an arrow that points up. Go to *Edit Curves > Open/Close Curves* to close the arrow icon curve. Center the pivot point of the arrow icon *(Modify > Center Pivot).* Name it "RootControl."

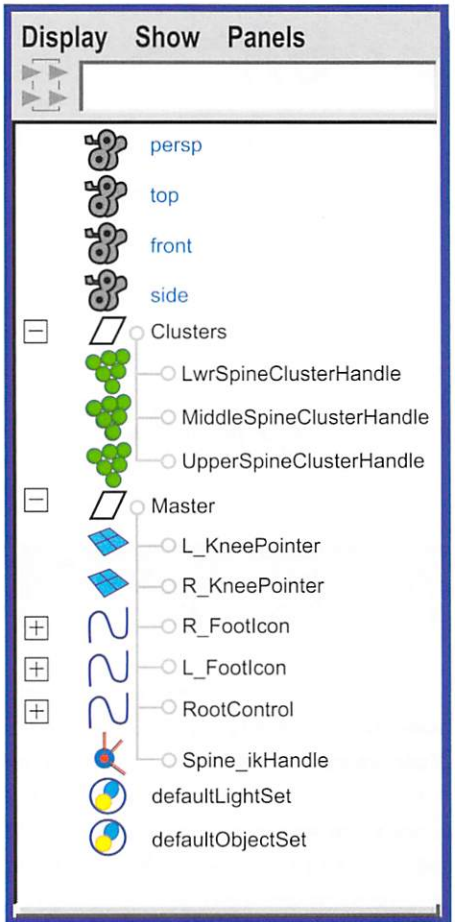
In the Outliner, select the "Root" joint and middle-click/drag it on top of the "RootControl" arrow icon. Now the arrow icon is the parent of the root joint.

Select the left elbow pole vector object (the primitive cone named "L_ElbowPointer"). In the Outliner window, middle-click/drag it on top of the "Root Control" (arrow icon). Repeat this parenting step with the other elbow pole vector (the torus primitive).

In the Outliner, middle-click/drag the arrow icon "RootControl" on top of the group named "Master." The spine curve should also be inside the "RootControl" arrow icon. The order of objects inside the Master group is:

- Master
  - L_KneePointer
  - R_KneePointer
  - L_FootIcon
  - R_FootIcon
  - RootControl
    - Root
    - Spine Curve

Test the rig by moving the "RootControl" arrow icon. All parts of the body should move except for the left and right knee pointers and the left and right foot icons. Be sure to undo everything to restore the rig back to its original position. When you need to move the entire rig and all the components, select the folder called "Master" in the Outliner window. Figure 52 shows the



persp
top
front
side
Clusters
LwrSpineClusterHandle
MiddleSpineClusterHandle
UpperSpineClusterHandle
Master
L_KneePointer
R_KneePointer
R_FootIcon
L_FootIcon
RootControl
Spine_ikHandle
defaultLightSet
defaultObjectSet

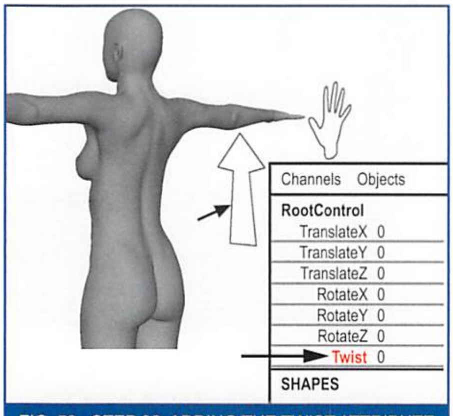
FIG. 52– STEP 31 CONTINUED. MAKING THE MASTER FOLDER IN THE OUTLINER. NOTICE THE SPINE CLUSTERS ARE LEFT OUTSIDE OF THE MASTER FOLDER. THE ELBOW POLE VECTOR PRIMITIVES ARE INSIDE THE ROOT JOINT

arrangement of all the objects and folders as seen in the Outliner. The spine clusters can remain outside of the Master folder because Set Driven Keys can be made to drive those with the root arrow icon. This will be discussed in Step 33.

## STEP 32

One more attribute will be added to the "RootControl" arrow icon. Go to *Window > General Editors > Channel Control...* In the Channel Control option box, under Keyable, select scaleX, scaleY, scaleZ, and Visibility, and click the Move button to remove them from the Channel Editor.

Go to *Modify > Add Attribute...* For the Attribute Name type in Twist and click OK. There is no need to type a value. Under the Channel Editor, you should now see the word "Twist" *(Figure 53)*.



RootControl
TranslateX 0
TranslateY 0
TranslateZ 0
RotateX 0
RotateY 0
RotateZ 0
Twist 0

FIG. 53– STEP 32. ADDING THE TWIST ATTRIBUTE TO THE ROOT CONTROL ARROW ICON

Go to *Window > General Editors > Connection Editor...* In the Connection Editor, click the Reload Left button to load the various attributes for the "RootControl." Scroll down all the way to the bottom and click the "Twist" attribute name. Leave the Control Editor open, and in your perspective view, select the spine IK Handle located between the arm bones. Click the Reload Right button located at the top right. The IK Handle's attributes are now loaded in the right column. Scroll down until you see the word "Twist" in the right column and select it. With the name "Twist" selected in both columns, the two attributes are automatically connected. Close the Connection Editor. You can test this attribute by selecting the "RootControl" arrow icon, going to the Channel Editor, highlighting the word "Twist," and middle-click/dragging in the perspective window left and right. The "Twist" values will change. If you select the IK Handle of the spine you will notice that next to the "Twist" name in the Channel Editor, it has the same value as the "RootControl" arrow icon had in its Channel Editor.

## STEP 33

The "RootControl" can also be made to control the flexibility of the spine with Set Driven Keys moderating the movements of the three spine Clusters.

Select the "RootControl" arrow icon and go to *Modify > Add Attribute...* In the Add Attribute box, next to Attribute Name, type the following names with a Minimum of -10, Maximum 10, and a Default of 0. Click the Add button for each to put them in the arrow icon's Channel box. The attributes are:

LwrSpineZ
LwrSpineX
MdlSpineZ
MdlSpineX
UprSpineZ
UprSpineX

After closing the Add Attribute box, go to *Animation > Animate > Set Driven Key > Set > Option.* Load the "RootControl" arrow icon as the Driver. Select the lower spine Cluster Handle and load it as the Driven.

In the right hand column, under the Driver heading, select "LwrSpineZ." Under Driven, select "translateZ" in the column on the right. Press the Key button to key the lower spine Cluster Handle in its neutral position.

Under Driver, select the "RootControl" and in the Channel box, next to "LwrSpineZ," type 10. Under Driven, select the lower spine Cluster Handle and move it forward to bend the lower part of the spine frontward, which in turn makes the stomach stick out. Press the Key button.

Under Driver, select the "RootControl" and in the Channel box, next to "LwrSpineZ," type -10. Under Driven, select the lower spine Cluster Handle and move it back to bend the lower part of the spine backward, which in turn makes the stomach go in. Press the Key button.

Under Driver, select the "RootControl" and in the Channel box, next to "LwrSpineZ," type 0 to return the lower spine back to its neutral position.

In the right hand column, under the Driver heading, select "LwrSpineX." Under Driven, select "translateX" in the column on the right. Press the Key button to key the lower spine Cluster Handle in its neutral position.

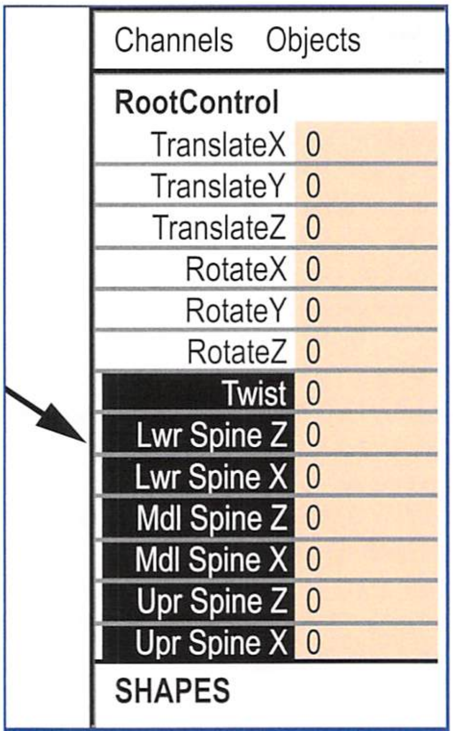
Under Driver, select the "RootControl" and in the Channel box, next to "LwrSpineX," type 10. Under Driven, select the lower spine Cluster Handle and move it to the right on the X axis, which makes the pelvis tilt. Press the Key button.

Under Driver, select the "RootControl" and in the Channel box, next to "LwrSpineX," type -10. Under Driven, select the lower spine Cluster Handle and move it to the left on the X axis to tilt the pelvis in the opposite direction. Press the Key button.

Under Driver, select the "RootControl" and in the Channel box, next to "LwrSpineX," type 0 to return the lower spine back to its neutral position.

Select the middle spine Cluster Handle and load it as the Driven in the Set Driven Key box. Follow all the previous steps to make the spine bend in the middle on the Z and X-axes. Do the same with the upper spine Cluster Handle.

You should now have full control of the spine with the "RootControl" arrow icon *(Figure 54 Next Page)*. The spine Clusters can now be hidden either through the Attribute Editor or by placing them in a Layer with other Clusters.



Channels Objects

**RootControl**

| | |
|---|---|
| TranslateX | 0 |
| TranslateY | 0 |
| TranslateZ | 0 |
| RotateX | 0 |
| RotateY | 0 |
| RotateZ | 0 |
| Twist | 0 |
| Lwr Spine Z | 0 |
| Lwr Spine X | 0 |
| Mdl Spine Z | 0 |
| Mdl Spine X | 0 |
| Upr Spine Z | 0 |
| Upr Spine X | 0 |

**SHAPES**

FIG. 54– STEP 33, EXTRA ATTRIBUTES IN THE ROOT CONTROL CHANNEL BOX FOR CONTROLLING THE SPINE CLUSTERS

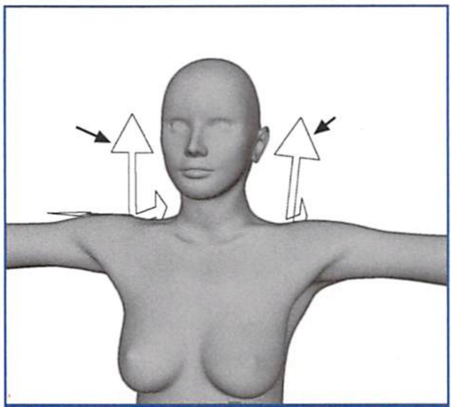


FIG. 55– STEP 34, THE SHRUG IS CONTROLLED WITH THE SHOULDER ICONS ACTING AS POINT CONSTRAINTS TO THE TWO SHOULDER JOINTS

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## STEP 34

The two shoulder joints can be controlled with Point Contstraints. Create two icons such as those seen in Figure 55. Parent them to the Root Control icon. Select the left shoulder icon, delete its history, and go to *Modify>Freeze Transformations.* While the left shoulder icon is still selected, Shift-select the left shoulder joint. Go to *Animation>Contrain>Point.* Select the left shoulder icon and Shift select the Root Control arrow icon. Press "p" to parent the shoulder icon to the Root Control arrow icon. Repeat this process for the other shoulder joint.

Some of you may prefer to just make blend shapes or morph targets for the shoulder shrug. The advantage to these is that they can keep the file size down and also give you greater control over the appearance of the mesh. The technique for creating blend shapes that alter the body to fix unsightly deformations at the joints is also used for creating the shrug. The next issue will discuss this topic.

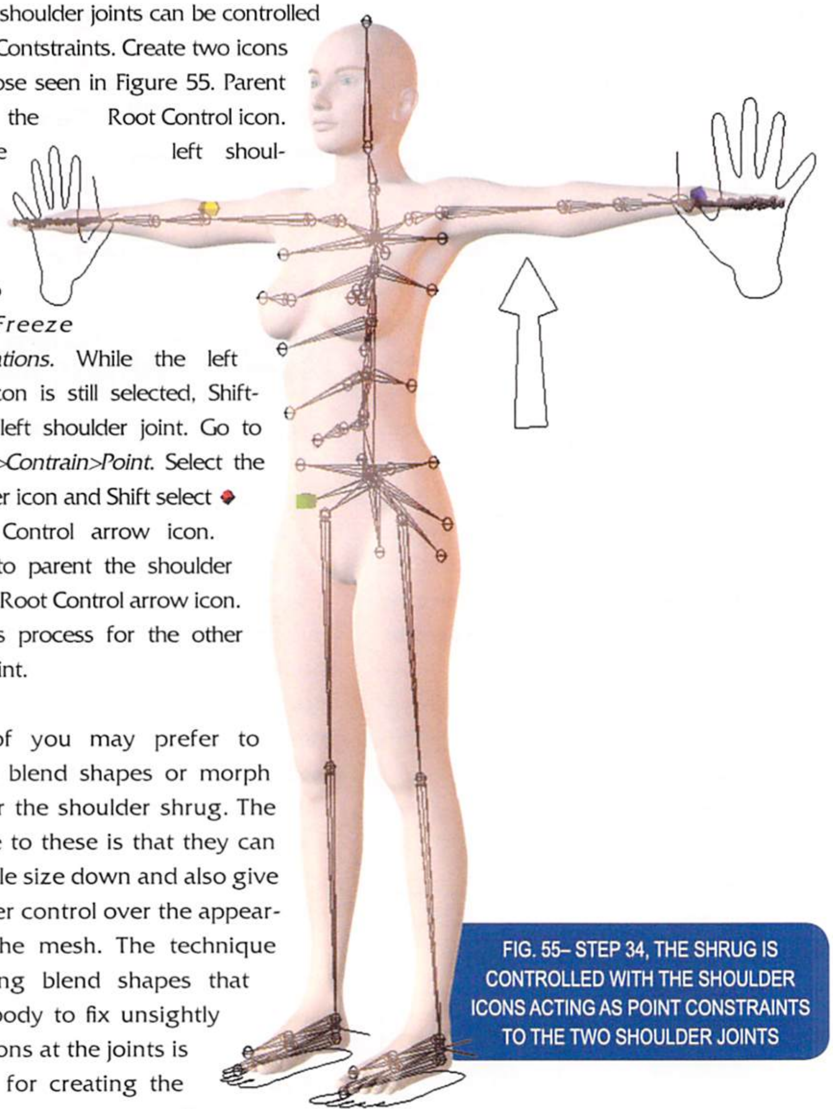

FIG. 55– STEP 34, THE SHRUG IS CONTROLLED WITH THE SHOULDER ICONS ACTING AS POINT CONSTRAINTS TO THE TWO SHOULDER JOINTS

This completes the IK skeleton set up. Figure 56 shows the skeleton with all its icons and controllers. Notice the extra joints at the breasts. They are parented to the "spine5" joint and keep the breasts from collapsing when the spine bends. More joints have also been added to the torso so that there is less time spent painting weight maps.

The next issue will discuss rigid and smooth binding as well as creating blend shapes (morphs). Character sets and using the Trax Editor are also subjects that will be covered in future issues, since these will get you started with Maya's way of animating digital humans.

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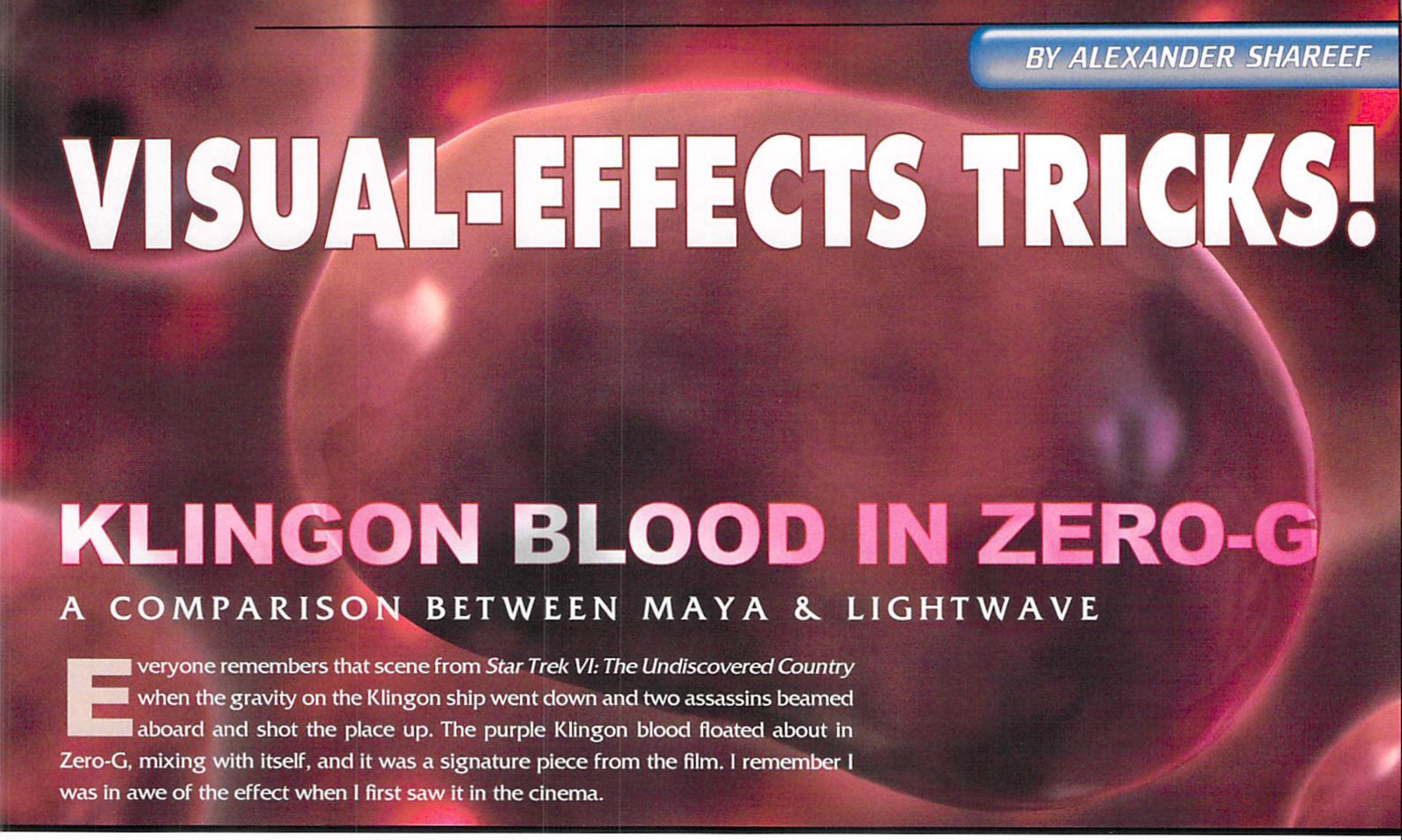


BY ALEXANDER SHAREEF

# VISUAL-EFFECTS TRICKS!

## KLINGON BLOOD IN ZERO-G

### A COMPARISON BETWEEN MAYA & LIGHTWAVE

Everyone remembers that scene from *Star Trek VI: The Undiscovered Country* when the gravity on the Klingon ship went down and two assassins beamed aboard and shot the place up. The purple Klingon blood floated about in Zero-G, mixing with itself, and it was a signature piece from the film. I remember I was in awe of the effect when I first saw it in the cinema.

Even though it seemed a breakthrough technique at the time, nowadays it's actually relatively easy to recreate in many 3D packages straight out of the box. In fact, these days, it's such a simple trick to do that I realized it would be a great opportunity to do something unique and interesting with this tutorial. It's something that I've always wanted as a reader myself: a side-by-side comparison of the same technique done simultaneously in two 3D packages.

What I'm going to do in this tutorial is try to recreate that floating Klingon blood from *Star Trek VI*, but with the added interesting twist of doing it both in Maya and LightWave 3D at the same time. A lot of the time, the biggest blocker for learning a new piece of software is finding out where everything is kept or named in the new package, and which tools do similar things to what you're used to. For example, LightWave has Hypervoxels, but it's just a name specifically made by NewTek. So, hopefully, by writing the two programs alongside each other, I can show you what each of the features are (and where they are) in each package. This should be a great way for anyone with experience in either of the packages to compare each tool side-by-side.

First of all, though, let's break down the effect that we're trying to achieve. Remember, techniques are almost invariably the same no matter which 3D package you use, so it's important to get into the habit of breaking anything down into its constituent parts and planning ahead.

At its heart, the Klingon blood is a simple trick made possible by the use of Metaballs. Yes, that's Metaballs, not Meatballs. It's also sometimes known as Blobby Modeling, or in this case, Blobby Particles, when applied to an emitter. Basically, they're volumetric objects that attract and deform each other. In LightWave, these are *Hypervoxels*, and in Maya they are simply called *Blobby Particles*.

With this in mind, there are essentially two parts to the procedure; set up some interesting particle interactions using Metaballs, then create a purple material/shader and apply it onto the particles to finish the look. So, choose your poison and let's jump right in.

## MAYA:

### 1. INTRODUCTION & SCENE SETUP

Unlike LightWave, most 3D applications are not split up into multiple programs. Maya is no exception to this; however, it's a little different in that it groups each of the disciplines together into separate menus (i.e. Animation, Modeling, Dynamics, and Rendering). You'll notice that the menus at the top change depending on which mode you have selected. This is somewhat analogous to having multiple

CONTINUED ON PAGE 42

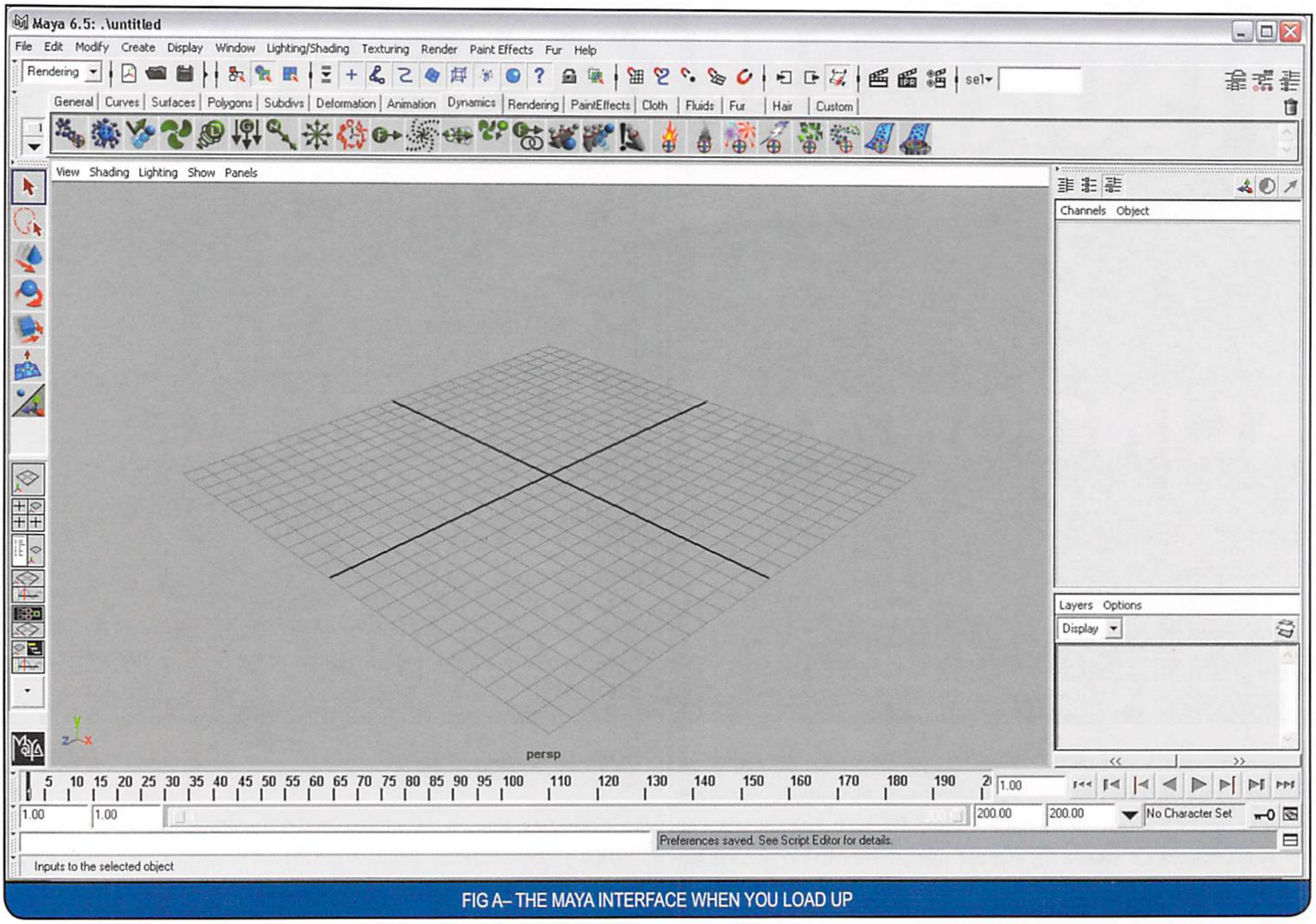
## LightWave:

### 1. INTRODUCTION & SCENE SETUP

The first thing you'll no doubt notice is that LightWave is split into two programs, one for modeling (LW_Modeler) and one for setting up the scene and doing everything else (LW_Layout). This seems strange at first, and is completely unlike nearly every other 3D application, but if you think about it, then you'll see that there are actually some comparisons with Maya. Maya's modules are dis-

CONTINUED ON PAGE 43

MAYA – CONTINUED FROM PAGE 41


Maya 6.5: .\untitled
File Edit Modify Create Display Window Lighting/Shading Texturing Render Paint Effects Fur Help
Rendering
sel▾
General | Curves | Surfaces | Polygons | Subdivs | Deformation | Animation | Dynamics | Rendering | PaintEffects | Cloth | Fluids | Fur | Hair | Custom
View Shading Lighting Show Panels
Channels Object
Layers Options
Display
persp
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 110 120 130 140 150 160 170 180 190
1.00
1.00 1.00
200.00 200.00
No Character Set

Preferences saved. See Script Editor for details.

Inputs to the selected object

FIG A– THE MAYA INTERFACE WHEN YOU LOAD UP

programs, but all contained in just the one software package. Also, if you're coming from LightWave, it actually makes a bit of sense; since having all the modeling tools in one module, it's similar to using the LW_Modeler program and switching back and forth.

Since there isn't any geometry to model or animate in this tutorial, we'll just stay in the "Dynamics" module for most of the tutorial. I'll be using Maya 6, but any version above 4 will do fine. Start up Maya, and switch to this mode using the dropdown menu on the left of the toolbar (Fig A).

## 2. CREATE PARTICLE EMITTER

Now that you're in the "Dynamics" module group, select Create Emitter from the Particles menu (Fig B). There is a little box next to each menu item, which is simply the options panel, but don't worry about that for the moment and simply use the default settings. This should now create a standard particle emitter in the center of the world. Click Play if you want, and you should see particles spitting out of the center. It's that simple to set up a particle emitter! In one step ...

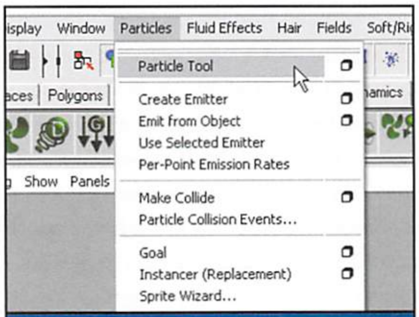

isplay Window Particles Fluid Effects Hair Fields Soft/Ri
ces | Polygons
Show Panels
amics
Particle Tool ❐
Create Emitter ❐
Emit from Object ❐
Use Selected Emitter
Per-Point Emission Rates
Make Collide ❐
Particle Collision Events...
Goal ❐
Instancer (Replacement) ❐
Sprite Wizard...

FIG B– THE SMALL BOX NEXT TO EACH ITEM WILL GIVE YOU THEIR OPTIONS

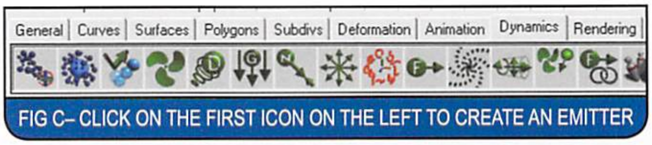

General | Curves | Surfaces | Polygons | Subdivs | Deformation | Animation | Dynamics | Rendering

FIG C– CLICK ON THE FIRST ICON ON THE LEFT TO CREATE AN EMITTER

In fact, Maya makes it even easier than that by having the icon tab shortcuts just above the main viewport. You'll notice they've provided a number of presets (General, Curves, Surfaces, and so on), but it's just as easy to create your own tab and organize them with your most used links. For example, the step above can just as easily be done by switching to the Dynamics icon tab and hitting the first icon, which is the Create Emitter link (Fig C).

CONTINUED ON PAGE 44

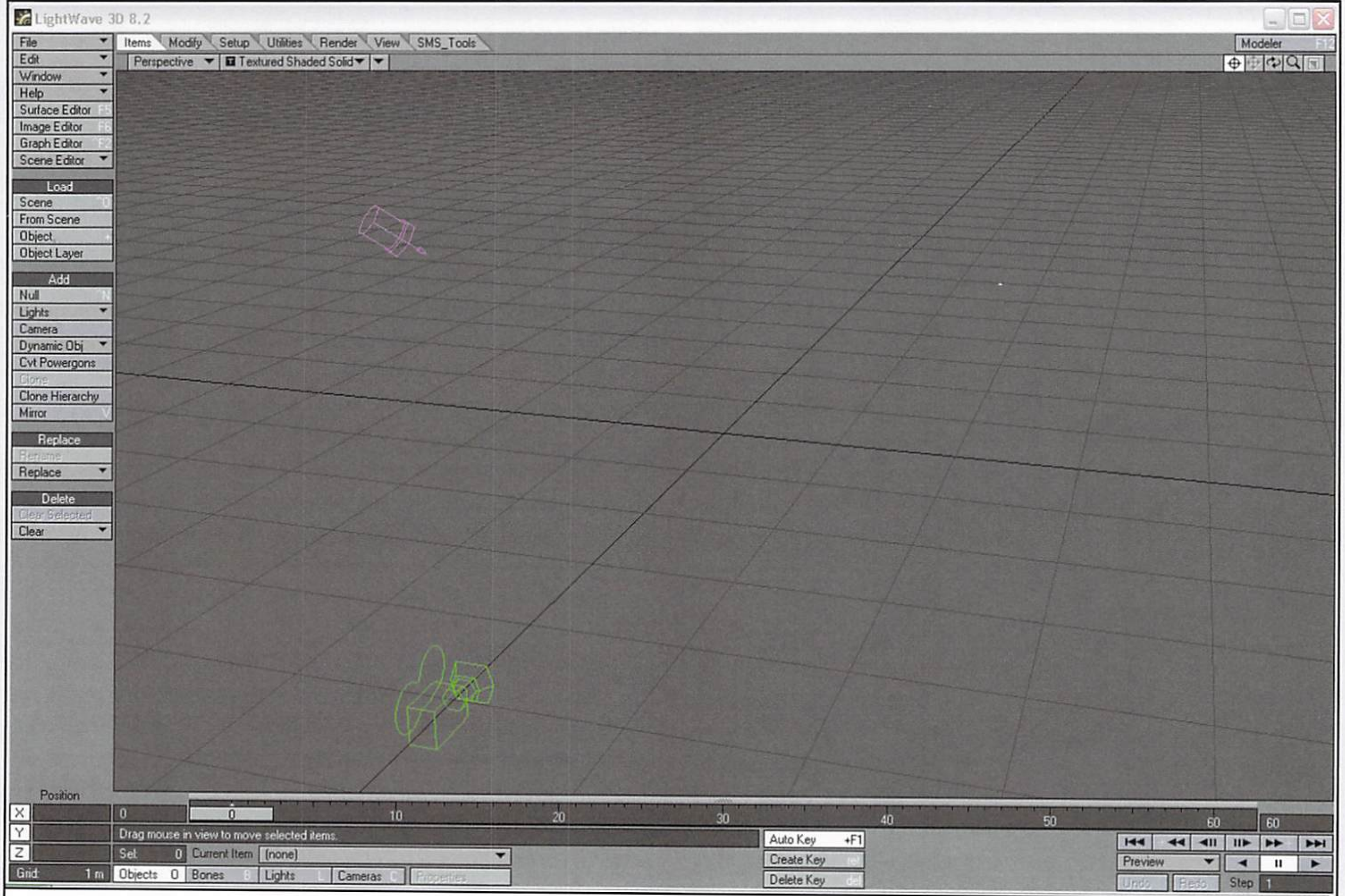
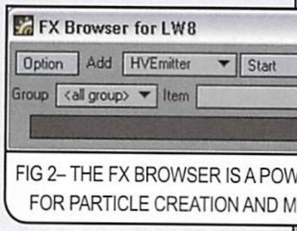
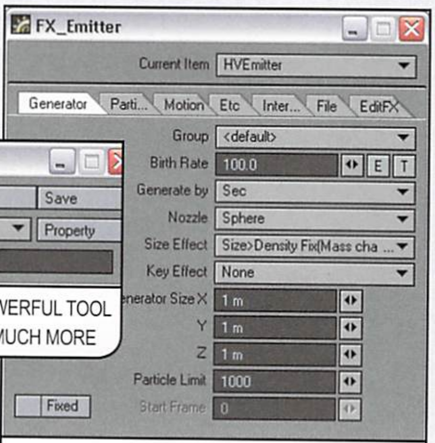

LightWave 3D 8.2
File
Edit
Window
Help
Surface Editor
Image Editor
Graph Editor
Scene Editor
Load
Scene
From Scene
Object
Object Layer
Add
Null
Lights
Camera
Dynamic Obj
Cvt Powergons
Clone
Clone Hierarchy
Mirror
Replace
Rename
Replace
Delete
Clear Selected
Clear
Items
Modify
Setup
Utilities
Render
View
SMS_Tools
Modeler
Perspective
Textured Shaded Solid
Position
X
Y
Z
Grid 1 m
Drag mouse in view to move selected items.
Sel 0
Current Item (none)
Objects 0
Bones
Lights
Cameras
Properties
Auto Key +F1
Create Key
Delete Key
Preview
Undo
Redo
Step 1
0
10
20
30
40
50
60

FIG 1– THIS IS LIGHTWAVE BEFORE WE'VE DONE ANYTHING


FX Browser for LW8
Option
Start
Save
Property

Add: HVEmitter
Group: <all group>
Item:

FIG 2– THE FX BROWSER IS A POWERFUL TOOL FOR PARTICLE CREATION AND MUCH MORE


FX_Emitter
Generator
Parti...
Motion
Etc
Inter...
File
EditFX
E
T
Fixed

Current Item: HVEmitter
Group: <default>
Birth Rate: 100.0
Generate by: Sec
Nozzle: Sphere
Size Effect: Size>Density Fix(Mass cha ...
Key Effect: None
Generator Size X: 1 m
Y: 1 m
Z: 1 m
Particle Limit: 1000
Start Frame: 0

FIG 3– SETUP THE PROPERTIES OF THE PARTICLE EMITTER

ciplines within the program that effectively split it up into separate parts and menus... so having a separate program for modeling is similar to always having to switch back to the modeling module in Maya. It's just a different way of thinking.

LightWave has complete integration between the two programs, meaning whatever you model in LW_Modeler will automatically update when you switch back to LW_Layout. For this tutorial, however, since we're not really going to model anything, we'll spend all of our time in LW_Layout (Fig 1). I'll be using LightWave 8.2, but anything from 6-7 upwards would probably be fine.

## 2. CREATE PARTICLE EMITTER

Under the Utilities tab, select FX Browser from the Plugins > Additional dropdown menu. This is the utility we're going to use to create our particle emitter (Fig 2). Like Maya, you can also customize the interface by creating your own tabs at the top (more on this later), which can be a great timesaver by having all your favorite links in one place.

In the FX Browser window, click on the dropdown menu next to Add, and simply select HVEmitter again. This will create a new particle emitter. If you play the scene, you'll notice the particles are being born inside the extents of the emitter.

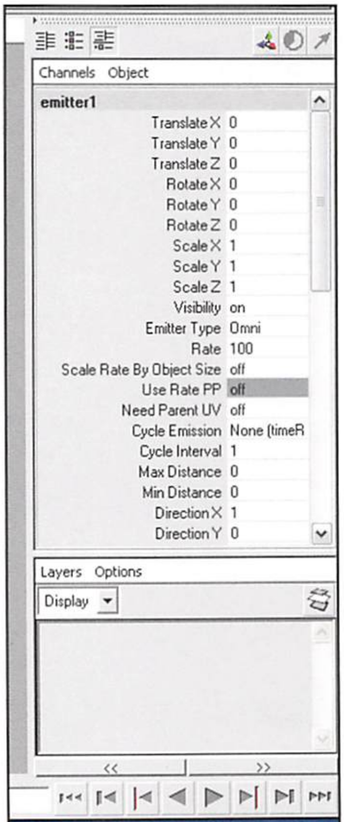
## 3. DEFINE EMITTER PROPERTIES

Since we've only created one particle emitter, it's automatically selected by default in the FX Browser, so simply click on the Properties. This will bring up another window (Fig 3) with a number of tabs along

CONTINUED ON PAGE 45

MAYA – CONTINUED FROM PAGE 42

## 3. DEFINE EMITTER PROPERTIES


Channels Object
Layers Options
Display
<< >>

emitter1

| | |
|---|---|
| Translate X | 0 |
| Translate Y | 0 |
| Translate Z | 0 |
| Rotate X | 0 |
| Rotate Y | 0 |
| Rotate Z | 0 |
| Scale X | 1 |
| Scale Y | 1 |
| Scale Z | 1 |
| Visibility | on |
| Emitter Type | Omni |
| Rate | 100 |
| Scale Rate By Object Size | off |
| Use Rate PP | off |
| Need Parent UV | off |
| Cycle Emission | None (timeR |
| Cycle Interval | 1 |
| Max Distance | 0 |
| Min Distance | 0 |
| Direction X | 1 |
| Direction Y | 0 |

FIG D– THE CHANNEL EDITOR IS WHERE YOU CHANGE MOST OF THE SETTINGS

Now that we've created our emitter, it's a simple matter of setting up all the properties. This is done in Maya using the Channel Box/Layer Editor, which is that window docked on the right-hand side of the interface (Fig D). First thing to do is to change the Emitter Type to Volume Emitter. This will tell Maya that we simply want to emit particles from within a volume rather than a point. This does not change the particle type – they are still dots at the moment, but we'll change that later.

Next, let's increase the emission size, which is done simply by increasing the Scale to 10 on x, y, z. To shake up the particle's movement a bit, set the Random Direction to something like 3. You can also modify the Speed a bit if you want. This should give you something akin to (Fig E). Now we're cooking.

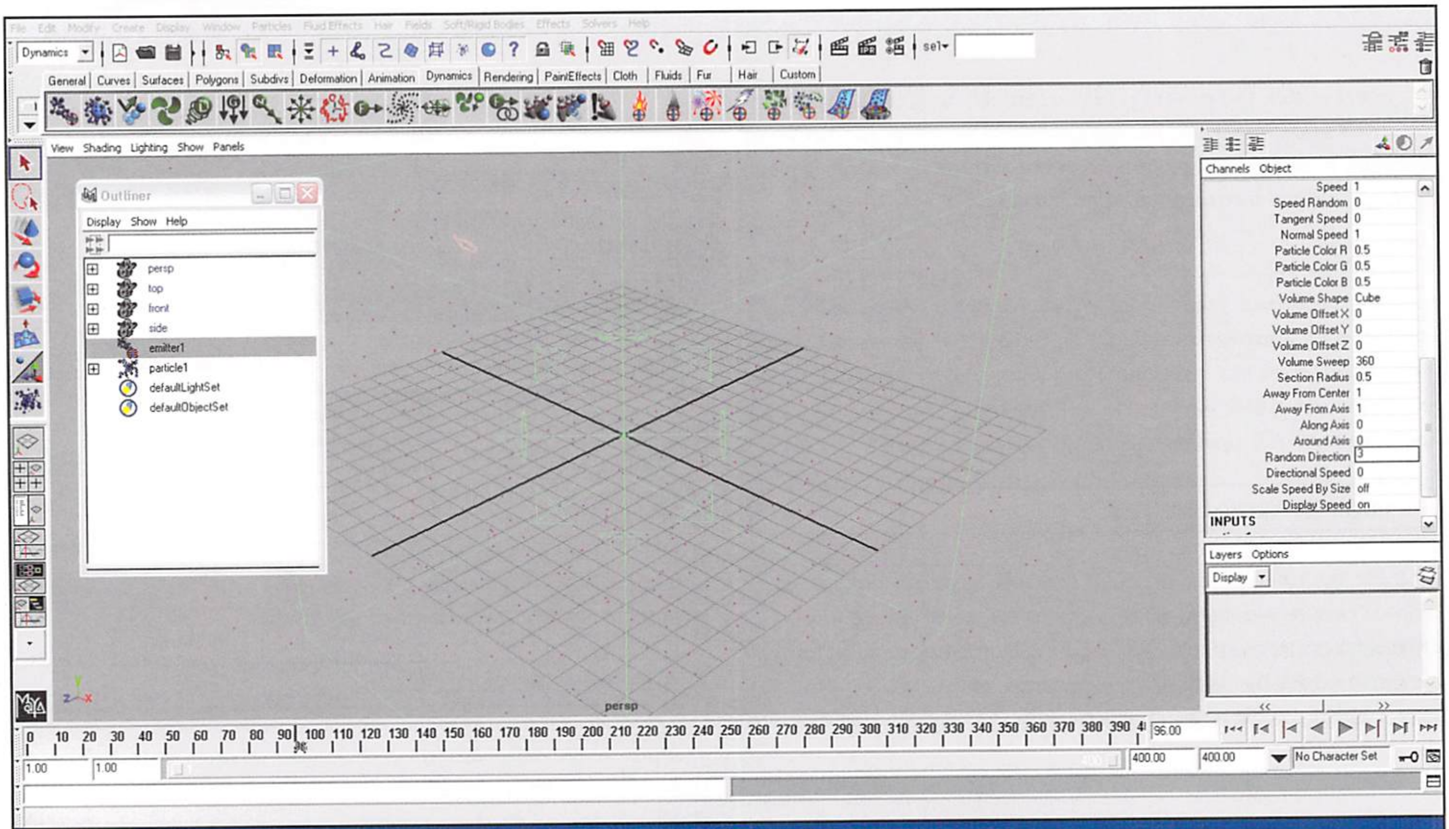
## 4. MAKING THE PARTICLES BLOBULAR

Now that the particles are moving about nicely, let's jump in and give them that blobular nature. In (Fig E) you'll notice I have the outliner open; this is the scene manager and is extremely handy for selecting objects in a scene by their name. It's found in *Window > Outliner*, but I always add it as one of my crucial shortcut icons (Shift+drag onto menu). In the list, you should see Emitter1 and Particle1, which could seem confusing at first, but actually makes sense. Maya emits particles from emitters, and by having these as separate objects, you can set up their properties separately. Think of it as the emitter controlling how all the particles behave as a whole (a normal HVEmitter in LW), and the particle controlling how each individual particle looks (similar to Hypervoxels in LW).

Select Particle1, and then in the channel box properties on the right, change the Particle Render Type to Blobby Surface. In the main viewport, this should change the particle dots into circles. We've just changed the particles from dots to metaballs. If you rendered now, all you'd see were spheres in place of the particles.

We need to change some options to make it appear blobby. For this, bring up the Attribute Editor (press Ctrl+A) and go into the particleShape1 tab, then under Render Attributes, click on Current Render Type, which should reveal "Radius" and "Threshold" (Fig F, on page 22). Change the Radius to something like 4, and change the Threshold to 0.5. The important setting here is the Threshold, since this affects the amount of blending each particle exerts on the other.

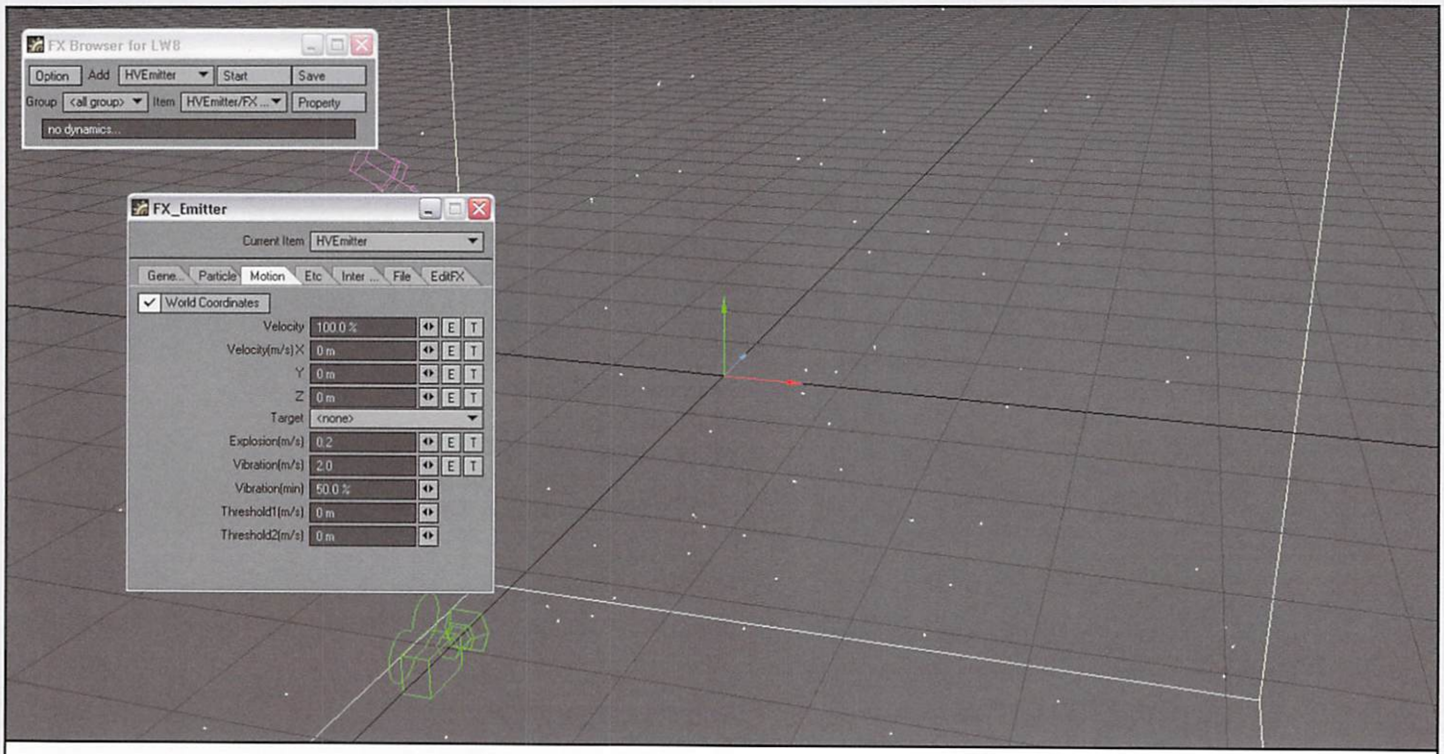
CONTINUED ON PAGE 46


Dynamics
General Curves Surfaces Polygons Subdivs Deformation Animation Dynamics Rendering PaintEffects Cloth Fluids Fur Hair Custom
View Shading Lighting Show Panels
Outliner
Display Show Help
persp
top
front
side
emitter1
particle1
defaultLightSet
defaultObjectSet
persp
Channels Object
INPUTS
Layers Options
Display
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390
96.00
1.00
1.00
400.00
400.00
No Character Set

| | |
|---|---|
| Speed | 1 |
| Speed Random | 0 |
| Tangent Speed | 0 |
| Normal Speed | 1 |
| Particle Color R | 0.5 |
| Particle Color G | 0.5 |
| Particle Color B | 0.5 |
| Volume Shape | Cube |
| Volume Offset X | 0 |
| Volume Offset Y | 0 |
| Volume Offset Z | 0 |
| Volume Sweep | 360 |
| Section Radius | 0.5 |
| Away From Center | 1 |
| Away From Axis | 1 |
| Along Axis | 0 |
| Around Axis | 0 |
| Random Direction | 3 |
| Directional Speed | 0 |
| Scale Speed By Size | off |
| Display Speed | on |

FIG E– USE THE OUTLINER AS A SCENE MANAGER

LIGHTWAVE– CONTINUED FROM PAGE 43



Add: HVEmitter
Group: <all group>
Item: HVEmitter/FX ...
no dynamics...

Current Item: HVEmitter
☑ World Coordinates
Velocity: 100.0 %
Velocity(m/s) X: 0 m
Y: 0 m
Z: 0 m
Target: <none>
Explosion(m/s): 0.2
Vibration(m/s): 2.0
Vibration(min): 50.0 %
Threshold1(m/s): 0 m
Threshold2(m/s): 0 m

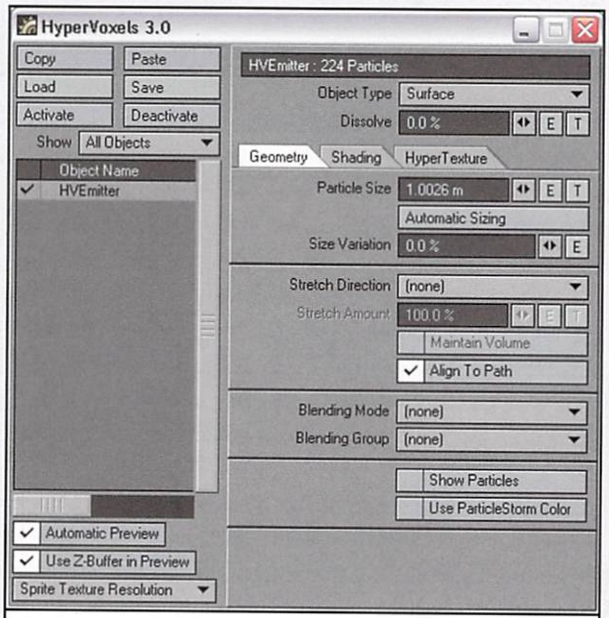
FIG 4– THIS IS HOW THE SCENE SHOULD LOOK WITH THE EMITTER IN

the top, and it's here that all the properties are set up for the emitter. Let's increase the emission area first, which is done by increasing the Generator Size to something like 10m on x, y, z. Leave everything else in the Generator and Particle tabs as they are for the moment, but under the Motion tab, change the Explosion to 0.2 m/s, make Vibration 2.0 m/s, and set Vibration (min) to about 50%. You can also increase the Velocity if you want, but all of this is simply designed to shake up the particle's movement within the emission area and make it look a bit more erratic. Feel free to play around a bit more, but by now you should be seeing something similar to (Fig 4).

## 4. MAKING THE PARTICLES BLOBULAR

So, even though the particles are doing something interesting now, you'll still get a black screen if you do a test render (just press F9). Let's go ahead and give them that blobular property that will make them react together like the Klingon blood. This is done in LightWave with a tool called Hypervoxels, which is actually a lot more than just Blobby particles, sharing some features with aspects of Maya's new Fluid Dynamics, and is quite an extensible volumetric renderer.

To add Hypervoxels, go to *Window > Volumetrics and Fog Options*, and then select it from the Add Volumetric dropdown menu. Double-click on it in the list to open the Hypervoxels settings panel. (Since I tend to use it quite a lot, I added it as a direct link in my custom menu tab.) Highlight the HVEmitter that we created earlier, and then click Activate. This will associate the Hypervoxels shader with our particle emitter. You can affect numerous particle emitters with just one Hypervoxel shader in this way by simply selecting (ticking) which ones get affected (Fig 5).



HVEmitter : 224 Particles
Show: All Objects
Object Name
✓ HVEmitter
Object Type: Surface
Dissolve: 0.0 %
Particle Size: 1.0026 m
Size Variation: 0.0 %
Stretch Direction: (none)
Stretch Amount: 100.0 %
☐ Maintain Volume
☑ Align To Path
Blending Mode: (none)
Blending Group: (none)
☐ Show Particles
☐ Use ParticleStorm Color
☑ Automatic Preview
☑ Use Z-Buffer in Preview
Sprite Texture Resolution

FIG 5– HYPERVOXELS GIVE THE PARTICLES THE BLOBULAR LOOK

A good analogy for comparing this with Maya is to think of the HVEmitter as the 'emitter' object, and the 'particle' object as being handled by Hypervoxels. The default settings will automatically create a metaball-type particle surface, so doing a test render now will show a pretty close approximation of what we're after already (Fig 6, top of page 47). You'll notice that we got to this step just slightly faster in LightWave than in Maya.

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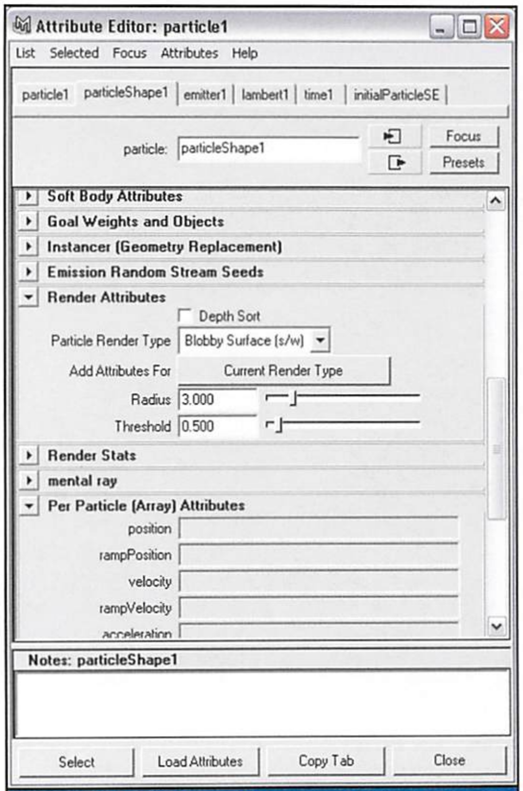
MAYA – CONTINUED FROM PAGE 44


Attribute Editor: particle1
List Selected Focus Attributes Help
particle1 particleShape1 emitter1 lambert1 time1 initialParticleSE
Focus
Presets
Soft Body Attributes
Goal Weights and Objects
Instancer (Geometry Replacement)
Emission Random Stream Seeds
Render Attributes
Add Attributes For
Current Render Type
Render Stats
mental ray
Per Particle (Array) Attributes
position
rampPosition
velocity
rampVelocity
acceleration
Notes: particleShape1
Select
Load Attributes
Copy Tab
Close

particle: particleShape1

☐ Depth Sort

Particle Render Type: Blobby Surface (s/w)

Radius: 3.000

Threshold: 0.500

FIG F– THE ATTRIBUTE EDITOR GIVES YOU EVERY SETTING YOU NEED

## 5. SHADING THE PARTICLES

If the Attribute Editor replaced the channel box in the step above, you can set it up in the *Window > Settings/Preferences > Preferences* to open as a separate undocked window. Let's render a test frame to see what we've got. The blobby surface particle requires a software renderer, which is what should be set up as default. You'll see three icons on the main toolbar that look like film-clappers. The last will give you the rendering options, the second is similar to LightWave's VIPER, and the first icon will render the scene. Try that now, and you'll see a bunch of gray particles all joining together when they touch (Fig G). Time to apply a shader that will make them look more like blood.

Unlike LightWave, where this is all handled within Hypervoxels, we've got to set up a specific shader and apply it to the particles. This is where I'll introduce you to the Hypershader, which is used for texturing/surfacing everything in Maya. Click *Window > Rendering Editors > Hypershade* to start it up (Fig H). At first sight, this will look totally alien to any LightWave users and may appear quite daunting. Give it some time, however, and you'll soon see how powerful it is.

Unlike LightWave, Maya splits surfaces into different types. Generally, a 'Lambert' shader is for general-purpose matte surfaces with no specularity, 'Blinn' is good for metals, 'Phong' works well for glass or plastics, and 'Anisotropic' is good for things like velvet or satin. For this tutorial, let's just use a Phong, as it will give us some nice specular highlights. Click on it once to create a new shader node.

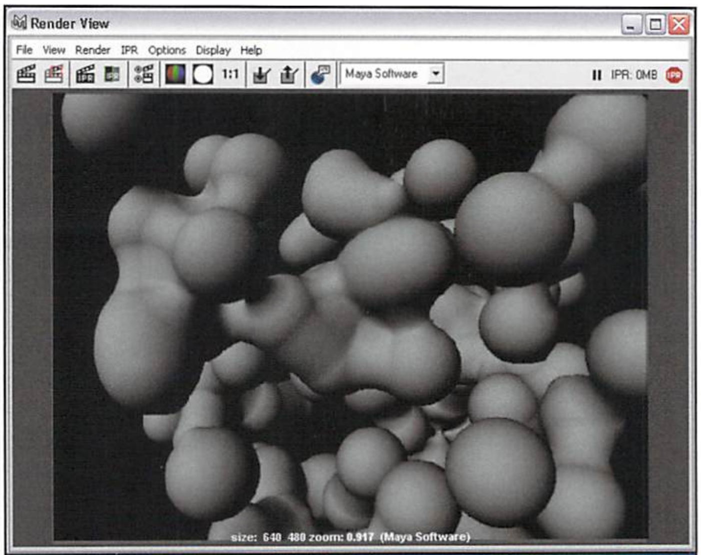

Render View
File View Render IPR Options Display Help
1:1
Maya Software
IPR: 0MB
size: 640 480 zoom: 0.917 (Maya Software)

FIG G– THE PARTICLES RENDERED WITH A STANDARD BLOBBY PARTICLE SETTING

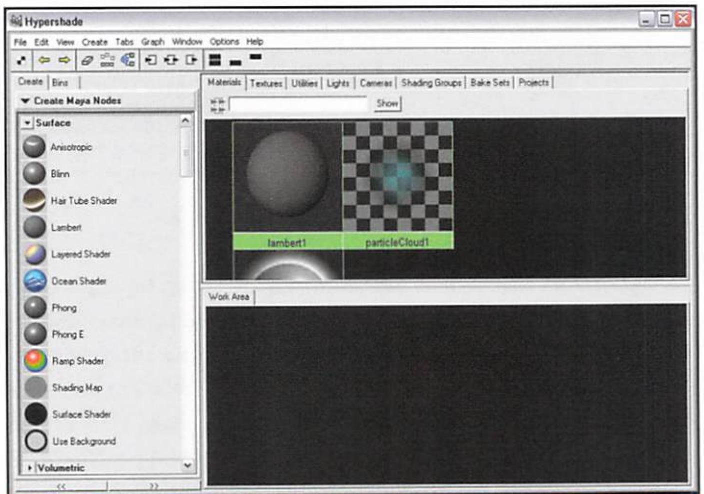
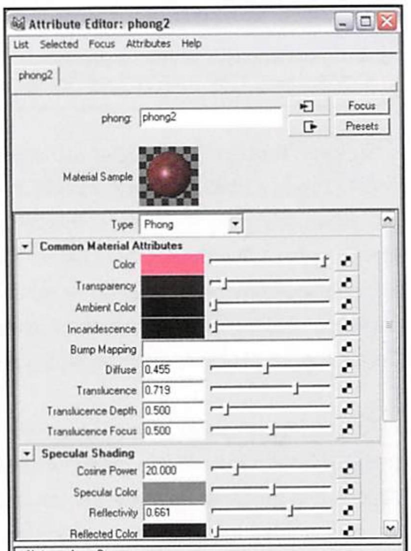

Hypershade
File Edit View Create Tabs Graph Window Options Help
Create Bins
Create Maya Nodes
Surface
Anisotropic
Blinn
Hair Tube Shader
Lambert
Layered Shader
Ocean Shader
Phong
Phong E
Ramp Shader
Shading Map
Surface Shader
Use Background
Volumetric
Materials Textures Utilities Lights Cameras Shading Groups Bake Sets Projects
Show
lambert1
particleCloud1
Work Area

FIG H– HYPERSHADER IS A NODE-BASED TEXTURING SOLUTION, AND VERY POWERFUL

Double-clicking on this new node will bring up the Attribute Editor with a far more familiar looking settings panel that will remind you of the Surface Editor in LightWave.

Go ahead and play around with the settings – I gave it the infamous Klingon Blood purple color (249,66,116), but with a hint of red, and ramped up the specular and reflections. My settings were as follows (Fig I):

CONTINUED ON PAGE 48


Attribute Editor: phong2
List Selected Focus Attributes Help
phong2
Focus
Presets
Material Sample
Common Material Attributes
Color
Transparency
Ambient Color
Incandescence
Bump Mapping
Specular Shading
Specular Color
Reflected Color
Notes: phong2
Select
Load Attributes
Copy Tab
Close

phong: phong2

Type: Phong

Diffuse: 0.455

Translucence: 0.719

Translucence Depth: 0.500

Translucence Focus: 0.500

Cosine Power: 20.000

Reflectivity: 0.661

FIG I– PLAY AROUND WITH THE SETTINGS TO GET THE DESIRED LOOK

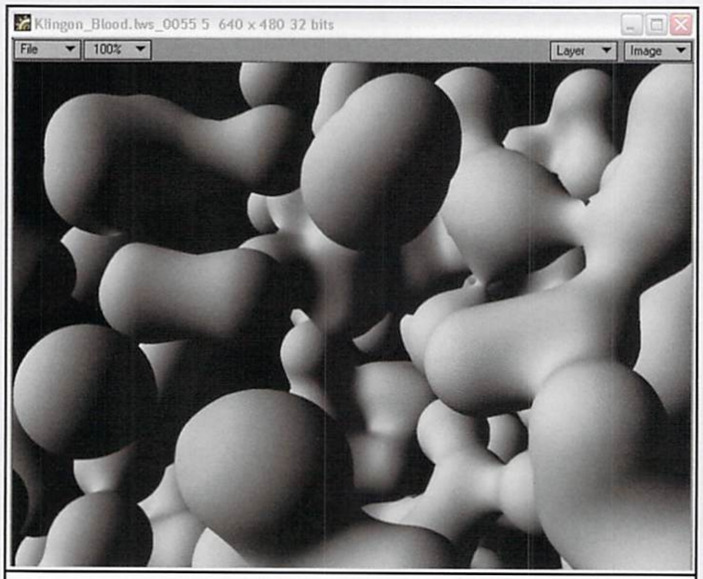
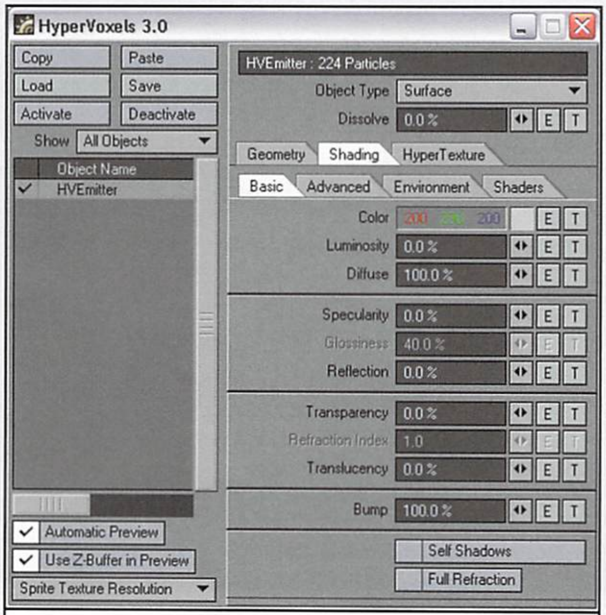

Klingon_Blood.lws_0055 5 640 x 480 32 bits
File
100%
Layer
Image

FIG 6– REMEMBER, THESE ARE METABALLS, NOT MEATBALLS


HyperVoxels 3.0
Copy
Paste
Load
Save
Activate
Deactivate
Object Name
Geometry
Shading
HyperTexture
Basic
Advanced
Environment
Shaders
E
T
Sprite Texture Resolution

Show: All Objects

✓ HVEmitter

HVEmitter : 224 Particles

Object Type: Surface

Dissolve: 0.0 %

Color: 200 200 200

Luminosity: 0.0 %

Diffuse: 100.0 %

Specularity: 0.0 %

Glossiness: 40.0 %

Reflection: 0.0 %

Transparency: 0.0 %

Refraction Index: 1.0

Translucency: 0.0 %

Bump: 100.0 %

☐ Self Shadows

☐ Full Refraction

☑ Automatic Preview

☑ Use Z-Buffer in Preview

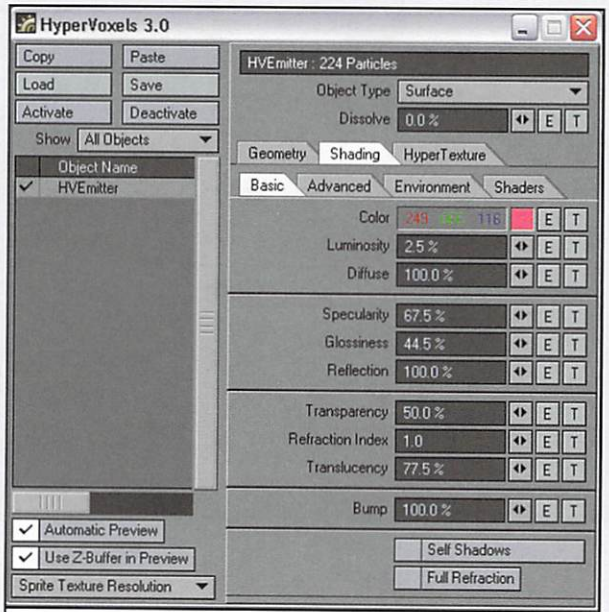
FIG 7– THE MATERIAL FOR THE PARTICLES IS CREATED WITHIN HYPERVOXELS

## 5. SHADING THE PARTICLES

You may have to play with the Particle Size in Hypervoxels a bit, but I found leaving it around 1.0 seemed fine for the moment. Let's change it from the drab gray look and define the shader a bit now. Coming from Maya, where you would now normally apply a material to the particle, you may be surprised to see that this is all still done within the Hypervoxels interface.

By the way, if you're finding it a pain to always have to go to the *Window > Volumetric and Fog Options > Hypervoxels 3.0* to start Hypervoxels, or any other tool for that matter, then simply add them as a shortcut to your own tab as discussed earlier. To do this, go to *File > Edit Menu Layout* and use the tool to create and organize your own menu bar at the top. I find using the search function here quite useful, and then I simply add each link to the menu. Trust me, this is a real timesaver.

Back in Hypervoxels, click on the Shading tab, and it should give you something similar to Maya shader's properties panel (Fig 7). This is actually a recreation of the same interface used by the Surface Editor (the main surfacing/texturing tool). In fact, you can compare the two (just press F5 or click on the Surface Editor link on the top left) and see they're almost identical. The advantage here is that with the Hypervoxels panel it really gives you a lot of control over fine-tuning the look and surface of the particles. There are also a lot of cool Preset settings ready made that you can apply. If you're feeling adventurous, save your scene now, and apply a few of the presets to try them out *(Window > Presets)*. Play around a bit until you're more accustomed to the interface, and then reload again when you're done.


HyperVoxels 3.0
Copy
Paste
Load
Save
Activate
Deactivate
Object Name
Geometry
Shading
HyperTexture
Basic
Advanced
Environment
Shaders
E
T
Sprite Texture Resolution

Show: All Objects

✓ HVEmitter

HVEmitter : 224 Particles

Object Type: Surface

Dissolve: 0.0 %

Color: 249 [illegible] 116

Luminosity: 2.5 %

Diffuse: 100.0 %

Specularity: 67.5 %

Glossiness: 44.5 %

Reflection: 100.0 %

Transparency: 50.0 %

Refraction Index: 1.0

Translucency: 77.5 %

Bump: 100.0 %

☐ Self Shadows

☐ Full Refraction

☑ Automatic Preview

☑ Use Z-Buffer in Preview

FIG 8– THESE ARE MY INITIAL SETTINGS, BUT FIDDLE A BIT

First thing to change is obviously the color. The Klingon Blood from the film is infamous for being a purplish tint, but I added a tad more red in there too so it would read better. Generally, I just played around with the settings to make it look a bit more viscous. Unfortunately, unlike Maya, there aren't any shader types (such as Phong, Blinn, etc.) that do half the work for you, so it's really just a matter of experimenting a bit.

Here are my final settings (Fig 8):

CONTINUED ON PAGE 49

MAYA – CONTINUED FROM PAGE 46

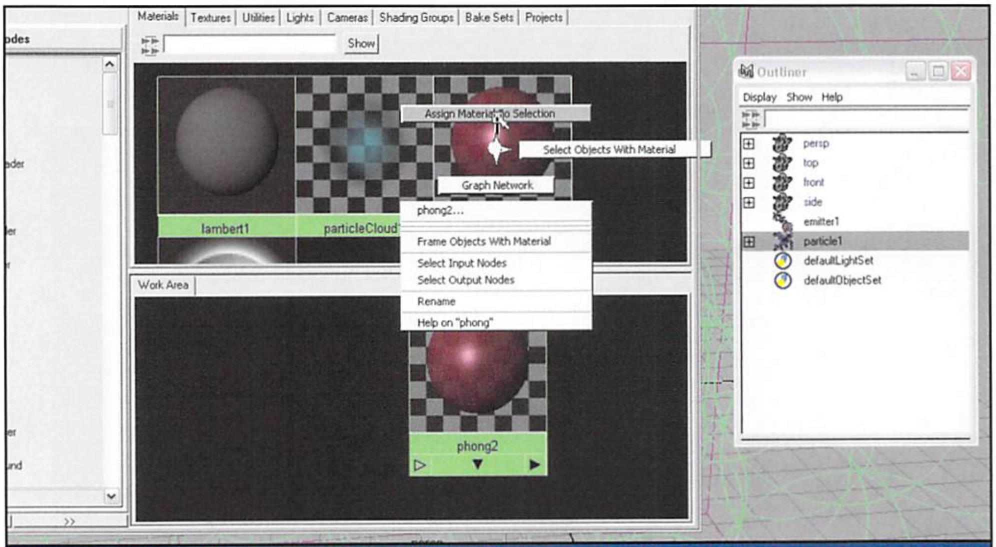

Materials
Textures
Utilities
Lights
Cameras
Shading Groups
Bake Sets
Projects
Show
lambert1
particleCloud1
Assign Material To Selection
Select Objects With Material
Graph Network
phong2...
Frame Objects With Material
Select Input Nodes
Select Output Nodes
Rename
Help on "phong"
Work Area
phong2
Outliner
Display
Show
Help
persp
top
front
side
emitter1
particle1
defaultLightSet
defaultObjectSet

FIG J– MAKE SURE YOU HAVE THE PARTICLE1 OBJECT SELECTED FIRST

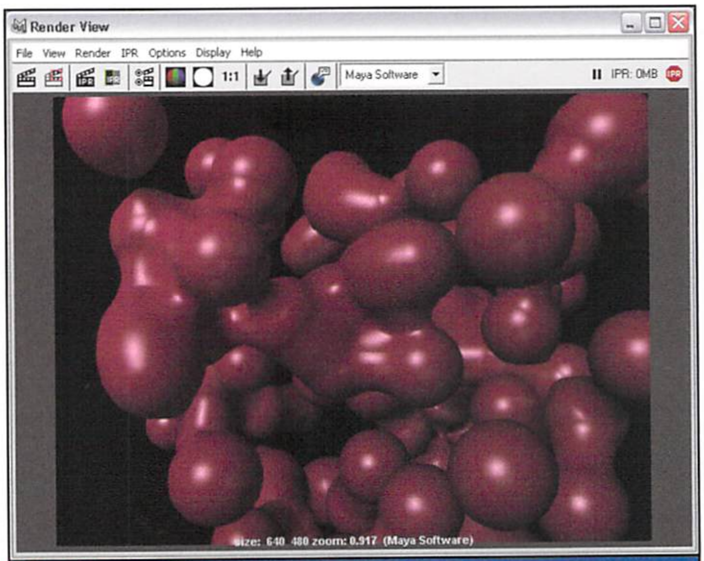

Render View
File
View
Render
IPR
Options
Display
Help
1:1
Maya Software
IPR: 0MB
Size: 640 480 zoom: 0.917 (Maya Software)

FIG K– PARTICLESS FULL OF BLOBBY GOODNESS

Now that you've got the shader set up, let's apply it to the particle node. This is actually quite easy – just select the 'Particle1' object from the Outliner (like in Fig E), then with this selected, right-click on the material and select Assign Material to Selection from the radial menu (Fig J). Note, you applied the shader to the particle, not to the emitter, which I hope makes sense to you.

## 6. MORE ADVANCED SHADING

Your blood should look something like (Fig K), which isn't quite there but it's a good starting foundation. Now we can delve deeper into Maya to enhance the look a bit more. The two obvious areas are adding reflections and breaking up the surface with a bump map, and then maybe after that, adding a fractal pattern to the color channel to add depth.

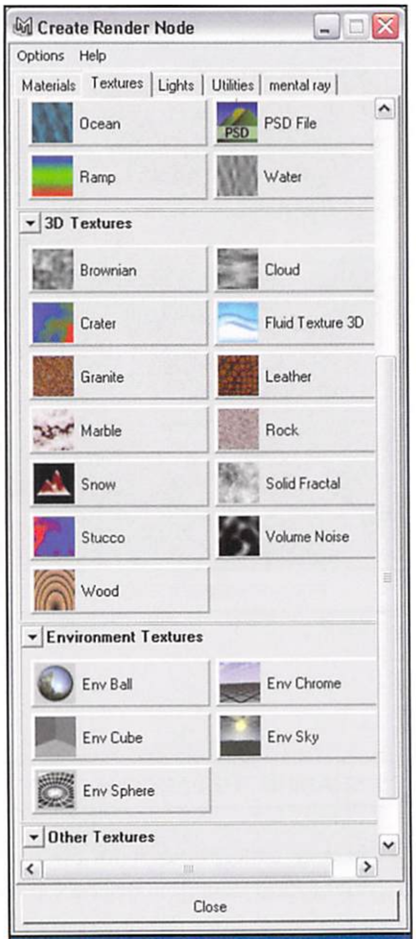

Create Render Node
Options
Help
Materials
Textures
Lights
Utilities
mental ray
Ocean
PSD File
Ramp
Water
3D Textures
Brownian
Cloud
Crater
Fluid Texture 3D
Granite
Leather
Marble
Rock
Snow
Solid Fractal
Stucco
Volume Noise
Wood
Environment Textures
Env Ball
Env Chrome
Env Cube
Env Sky
Env Sphere
Other Textures
Close

FIG L– THIS ACTS THE SAME AS A TEXTURE-PICKER

To set up the reflections, let's add an environment cube map to the Reflected Color channel. Click on that black and white checkered box, which is the same as the "T" feature in LightWave. From the Create Render Node menu that comes up, select Env Ball from the Environment Textures section. Now add an image for the map, which could be anything you like, but a general Fractal pattern is adequate. I chose Solid Fractal from the 3D Textures section of the Create Render Node menu (Fig L). At this point, your Attribute Editor will be in the Solid Fractal settings, and you can click on the two funny looking arrows near the top (next to Focus/Presets) to shuffle back up the chain to the main properties for the shader.

Click on the checkered box for the Bump Mapping channel, and add another Solid Fractal into this. However, this time let's change the settings a bit and reduce its effect. Bring the amplitude down to about 0.3-0.4, and play around with some of the other settings. By the way, clicking the animated tick box will make this fractal texture animate over time, which is handy if you want to make a movie.

Finally, let's repeat the whole process one more time, this time in the Color channel. This time, select Layered Texture from the Create Render Node menu. Before, we were replacing the channels with the

CONTINUED ON PAGE 50

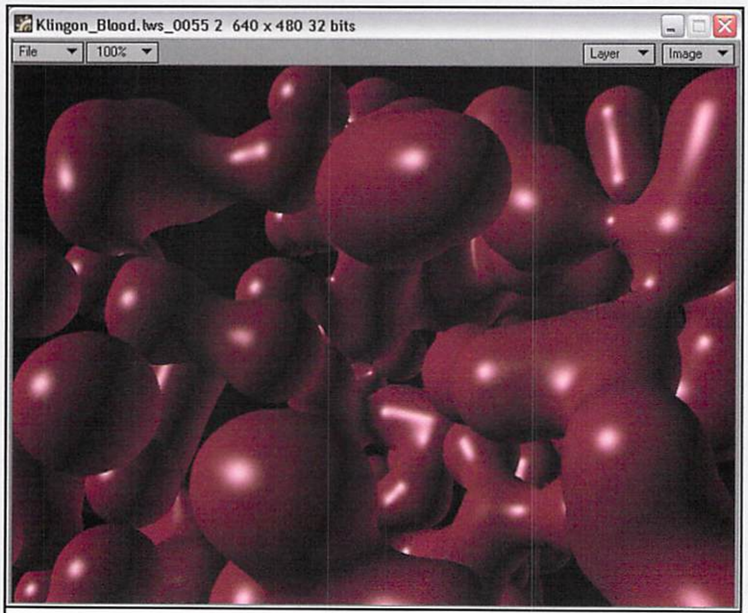
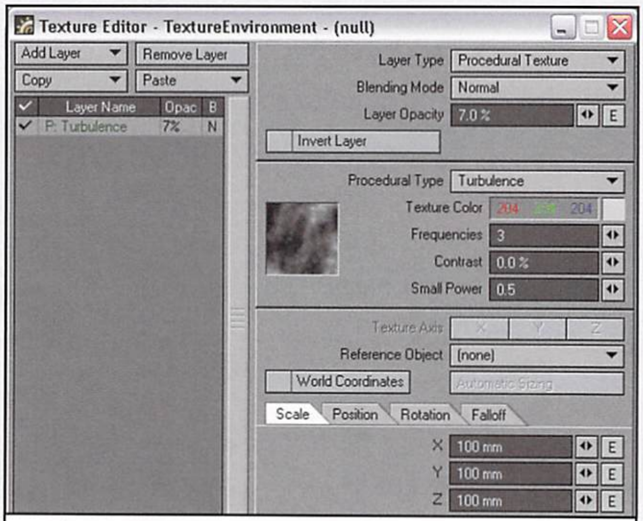

Klingon_Blood.lws_0055 2 640 x 480 32 bits
File
100%
Layer
Image

FIG 9– GETTING CLOSER. SPICY RED MEATBALLS


Texture Editor - TextureEnvironment - (null)
Add Layer
Remove Layer
Copy
Paste
Layer Name
Opac
B
Texture Axis
X
Y
Z
Automatic Sizing
Scale
Position
Rotation
Falloff

✓ P: Turbulence 7% N

Layer Type: Procedural Texture
Blending Mode: Normal
Layer Opacity: 7.0 %
☐ Invert Layer
Procedural Type: Turbulence
Texture Color: 204 204 204
Frequencies: 3
Contrast: 0.0 %
Small Power: 0.5
Reference Object: (none)
☐ World Coordinates
X: 100 mm
Y: 100 mm
Z: 100 mm

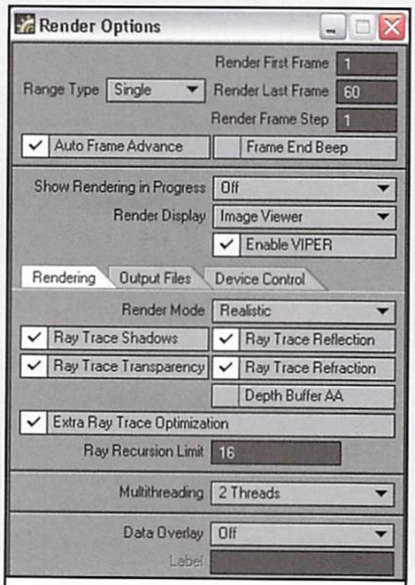
FIG 10– ADD AN ENVIRONMENT MAP, AND USE FRACTAL NOISE

## 6. MORE ADVANCED SHADING

By now, you'll probably have something like (Fig 9), which is a good starting point, but there are a few more things we can do to enhance the look.

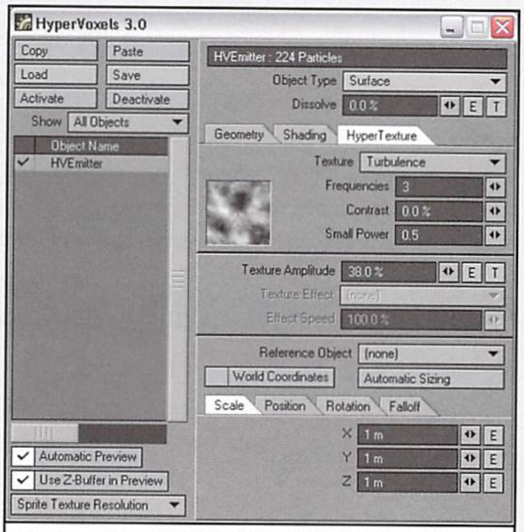
First off, let's set up the reflections with an environment map of sorts. If you select the Environment tab in the Hypervoxels window, you'll see that you have the option of several types of reflection types. For this tutorial, I used Ray Tracing + Backdrop, which will reflect each of the blood cells against each other and also add in a backdrop. To make this work, you need to change the background, which can be done in *Window > Backdrop Options.* It's not the best way, but it's fast and will do the trick for what we want. I added in a Textured environment from the Add Environment tab, and used a Fractal Noise pattern. Most of the 3D applications these days come with procedural generation, but I find LightWave's to be more extensible and powerful, as it was a big feature in much earlier versions. In the layer type, change it to Procedural Texture, and you'll have a load of different styles to choose from. I kept it on the default Turbulence and only changed the Size down to 0.1 on x, y, z. The other important thing is to set the Layer Opacity down to something like 9% so it's not too overwhelming (see Fig 10). LightWave's renderer must also be told to turn on Reflections / Shadows / Refraction in order for this to show up. This is done in the Render Options panel *(Render > Options > Render Options).* You'll see in (Fig 11) that I've turned all of these options on.

Another thing we can do to make it look better is to break up that perfectly smooth surface a bit with a bump map. In fact, we can do this in two places. First of all, select the HyperTexture tab; this is where you define the surface of the particles, making them look mottled, smoky, or ripply. From the Texture dropdown, select Turbulence, and leave all the default settings as they are, but bring the Texture Amplitude down a bit (Fig 12). The other place you can add some definition is in the actual shader bump map. Back in the *Shading > Basic tab,* you'll notice the "T" next to each option. Clicking this allows you to set up a texture to be used in the slot. Click that now, and in the Layer Type at the top, make it a


Render Options
Rendering
Output Files
Device Control

Render First Frame: 1
Range Type: Single
Render Last Frame: 60
Render Frame Step: 1
☑ Auto Frame Advance
☐ Frame End Beep
Show Rendering in Progress: Off
Render Display: Image Viewer
☑ Enable VIPER
Render Mode: Realistic
☑ Ray Trace Shadows
☑ Ray Trace Reflection
☑ Ray Trace Transparency
☑ Ray Trace Refraction
☐ Depth Buffer AA
☑ Extra Ray Trace Optimization
Ray Recursion Limit: 16
Multithreading: 2 Threads
Data Overlay: Off
Label

FIG 11– BE SURE TO HIGHLIGHT THESE OPTIONS IN THE RENDER MENU

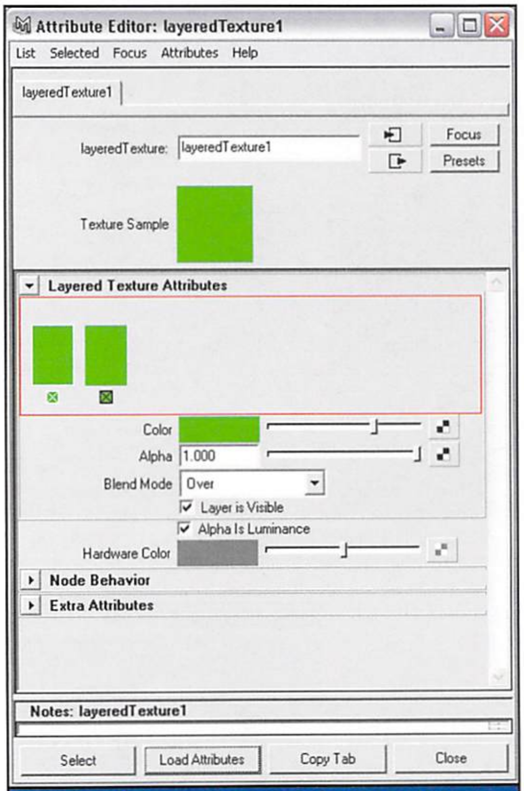

HyperVoxels 3.0
Copy
Paste
Load
Save
Activate
Deactivate
Object Name
Geometry
Shading
HyperTexture
Texture Effect
Effect Speed
Scale
Position
Rotation
Falloff
Sprite Texture Resolution

Show: All Objects
✓ HVEmitter
HVEmitter : 224 Particles
Object Type: Surface
Dissolve: 0.0 %
Texture: Turbulence
Frequencies: 3
Contrast: 0.0 %
Small Power: 0.5
Texture Amplitude: 38.0 %
Texture Effect: (none)
Effect Speed: 100.0 %
Reference Object: (none)
☐ World Coordinates
Automatic Sizing
X: 1 m
Y: 1 m
Z: 1 m
☑ Automatic Preview
☑ Use Z-Buffer in Preview

FIG 12– ADDING A HYPERTEXTURE BUMP WILL BREAKUP THE PARTICLES SURFACE

CONTINUED ON PAGE 51

MAYA – CONTINUED FROM PAGE 48


Attribute Editor: layeredTexture1
List Selected Focus Attributes Help
layeredTexture1
Focus
Presets
Texture Sample
Layered Texture Attributes
Color
Hardware Color
Node Behavior
Extra Attributes
Notes: layeredTexture1
Select
Load Attributes
Copy Tab
Close

layeredTexture: layeredTexture1

Alpha 1.000

Blend Mode Over

☑ Layer is Visible

☑ Alpha Is Luminance

FIG M– LAYERED TEXTURES ARE ACTUALLY QUITE POWERFUL

fractal patterns, but in the Color channel we want to have two separate layers of colors. What you'll get in the Attribute Editor is an interesting concept, whereby clicking anywhere in the red box will create a new texture layer, and you can edit them separately and blend them together to create the overall effect (Fig M). It's quite useful actually. Give the first texture the same color that you originally used for the material (249,66,116), as this will be the base layer. Then, add a fractal pattern onto the second layer. This time, under the *Color Balance > Color Gain* section, change the color to something with a pink/purple hue (232,2,105). Go back to the layered Texture panel and give the second layer an alpha of 0.5 or similar, and keep the blending on Over.

By the end of all this, you'll probably have something similar to (Fig N), but the important thing here is that I really want you to continue playing around with all of the different settings inside Maya. For example, add some more layers into the Color channel, or define a better reflection map. In the end, the best way to learn is by exploring the package.

## 7. FINE-TUNING

So, things are hopefully looking quite good by now. You've learned a bit about Maya's workings, how to set up the blobby particles, and played around with creating a shader to reproduce the look of the Klingon blood.

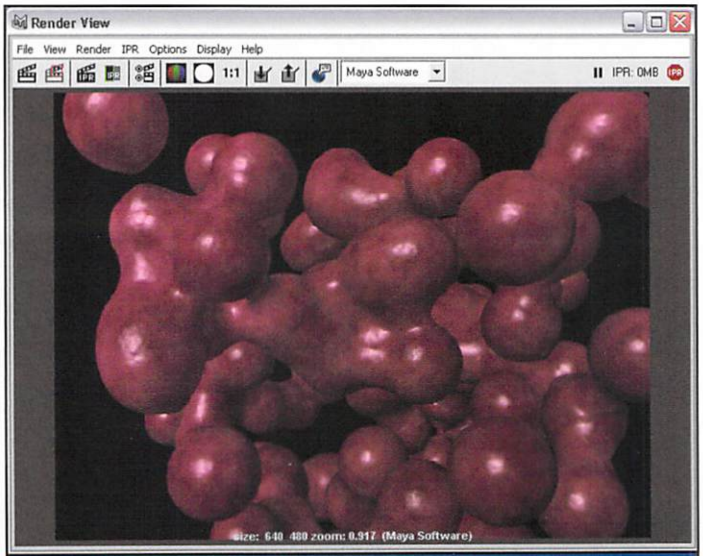

Render View
File View Render IPR Options Display Help
1:1
Maya Software
IPR: 0MB
size: 640 480 zoom: 0.917 (Maya Software)

FIG N– METABALLIC BLOBS OF BLOOD. BUT PERHAPS TOO MANY

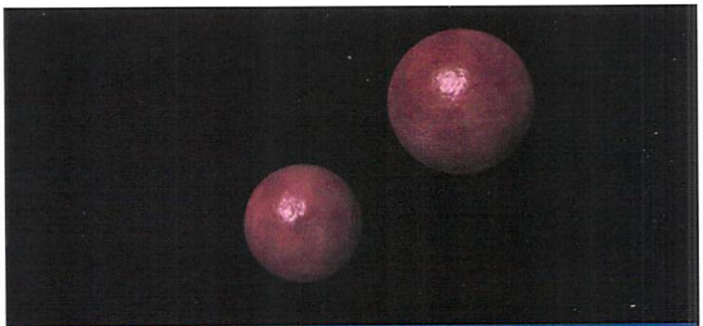


FIG O– NOT BAD...

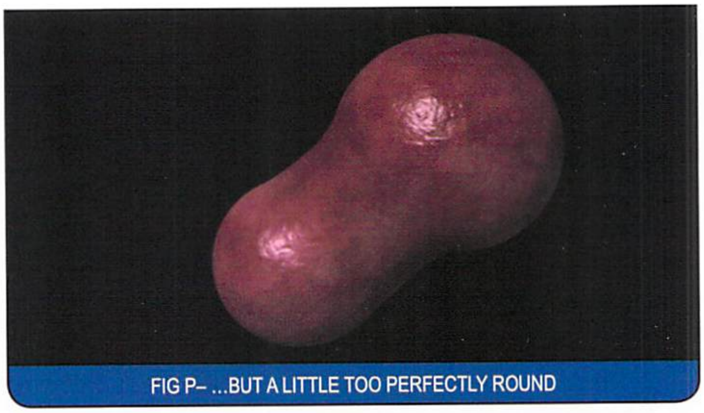


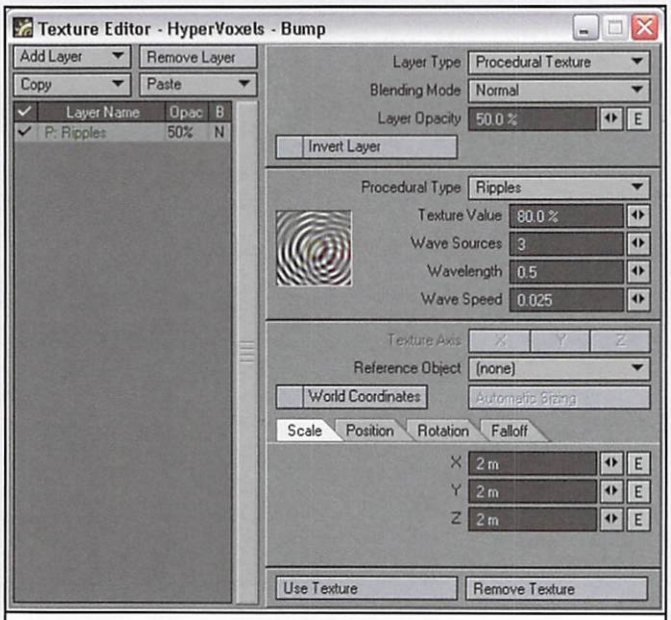
FIG P– ...BUT A LITTLE TOO PERFECTLY ROUND

The one thing that still isn't correct is that there are still far too many particles. You may remember in the film that there were only a few drops of blood floating about. So, even though it's been useful having so many particles for prototyping, let's correct this now.

Select emitter1 from the Outliner, then in the Channel Box Editor on the right hand side, change the rate to 2-3. Also reduce the scale to something like 1 on x, y, z. You'll have to move the camera in a bit closer, but you'll no doubt have something similar to (Fig O). Also, with a bit of playing around with the dynamics of the particles, you can get it so that the two drops of blood move together and merge into one (Fig P).

CONTINUED ON PAGE 52

*LIGHTWAVE– CONTINUED FROM PAGE 49*



Texture Editor - HyperVoxels - Bump

Layer Name: P: Ripples, Opac 50%, B N

Layer Type: Procedural Texture
Blending Mode: Normal
Layer Opacity: 50.0 %
Procedural Type: Ripples
Texture Value: 80.0 %
Wave Sources: 3
Wavelength: 0.5
Wave Speed: 0.025
Reference Object: (none)
Scale X: 2 m
Y: 2 m
Z: 2 m

FIG 13– A RIPPLY BUMP MAP CAN ALSO HELP TO ADD DEPTH

Procedural Texture. This is where the power of LightWave really comes into its own, with the procedurally generated textures. I added a Ripple type (Fig 13), just to break up the surface a bit.

One last quick touch that will really help sell it a bit further is to break up the color a bit with some darker shades. Press the "T" button next to Color, and add a Procedural Texture again. I kept the Turbulence and left the default settings, but changed the color to a pinky shade (232,2,105). This will break up the surface color with a fractal pattern. Feel free to add some more layers, as it will only add to create more depth.

After all that shading work, the blood should now look something like (Fig 14). Hopefully, you'll feel much more comfortable now playing around with all the different settings in Hypervoxels. The best way to learn something is always to explore and experiment with what can be done.

## 7. FINE-TUNING

By this stage, we should be looking pretty good. By now, you've found out how to apply Metaballs onto particles using Hypervoxels in LightWave, and have applied a quick shader to approximate the Klingon blood.

The only thing left to do is to fine-tune the look of the blood drops a bit. At the moment, there are way too many. This was good for prototyping, but in the film you'll remember that there were only a couple of drops of blood floating about. This can be remedied easily enough by reducing the particle count, so let's go ahead and do that now.

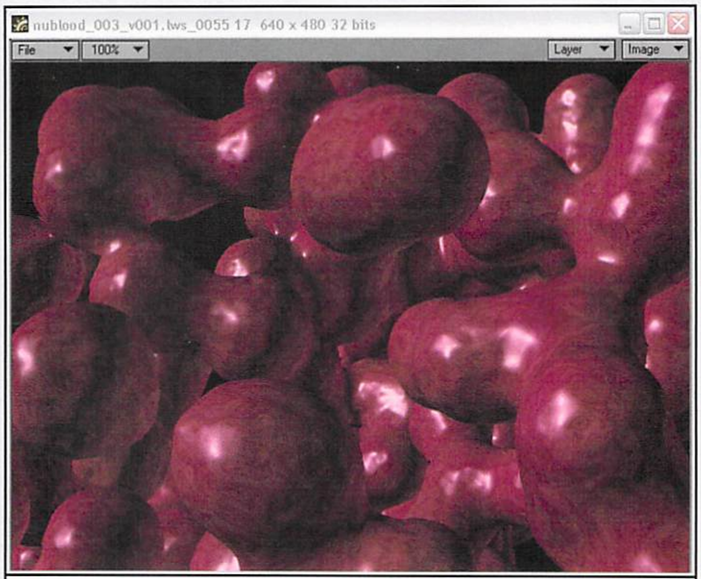


FIG 14– BLOODY BLOBS, BUT THERE ARE TOO MANY OF THEM!

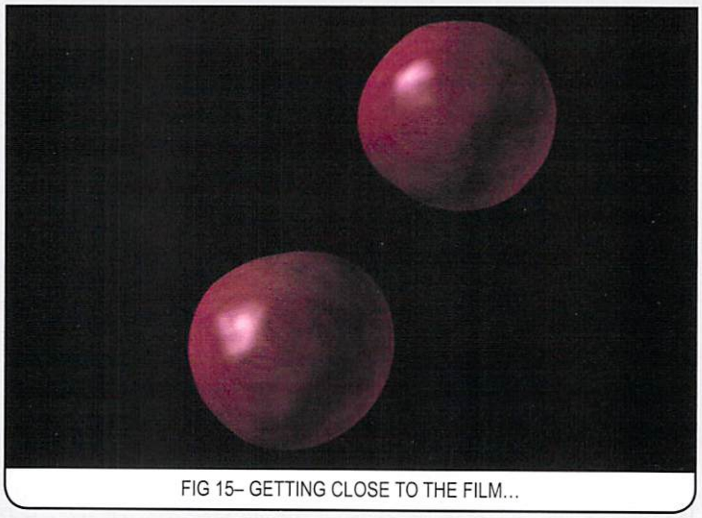


FIG 15– GETTING CLOSE TO THE FILM...

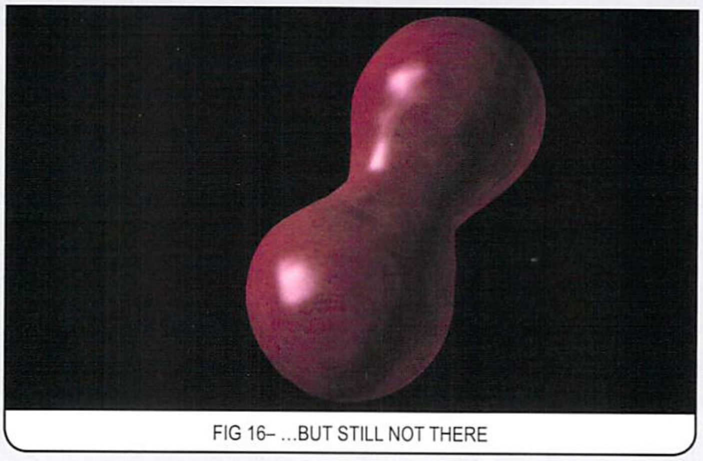
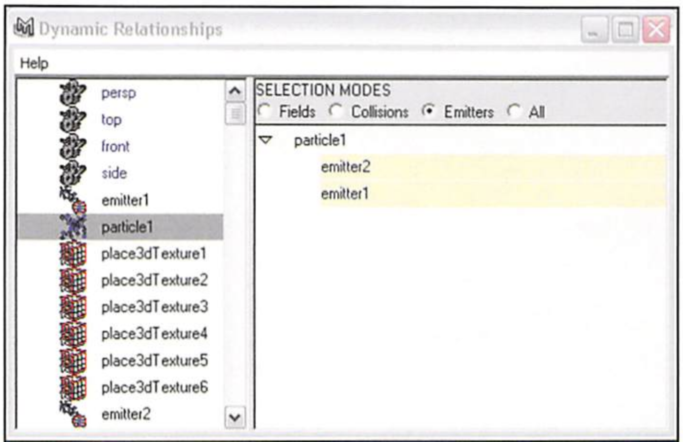


FIG 16– ...BUT STILL NOT THERE

In the FX Browser window, select the FX_Property of the Particle Emitter. Reduce the Birth Rate down to something like 2, and also bring the Generator Size down to 1m on x, y, z. Also change the Particle Limit to around 2-3. Move the camera in closer a bit more, and do a test render and hopefully you'll have something similar to (Fig 15). If you play around a bit with the dynamics of the particles, you can set up a scene where the two drops of blood appear to merge into one (Fig 16).

*CONTINUED ON PAGE 53*

MAYA – CONTINUED FROM PAGE 50



Dynamic Relationships

Help

persp
top
front
side
emitter1
particle1
place3dTexture1
place3dTexture2
place3dTexture3
place3dTexture4
place3dTexture5
place3dTexture6
emitter2

SELECTION MODES
○ Fields ○ Collisions ● Emitters ○ All

particle1
emitter2
emitter1

FIG Q– USE THE RELATIONSHIP EDITOR TO HOOKUP BOTH EMITTERS

## 8. ONE STEP FURTHER

So far, so good ... But, did you notice how circular and perfect looking the blood looked in Step 7? What about if we tried a different method that would not only look far better, but would also give us much more control over how the two blood droplets came together? Basically, what we'll do is take it one step further and create two particle emitters (one for each drop).

In the Outliner, select the emitter1 object and duplicate it with (Ctrl+D) or *Edit > Duplicate*. Move emitter2 away from the first, and do a test render. The second emitter isn't rendering, right? This is because we haven't given it particles to emit yet. Remember, since the particles and emitters are separate objects, they need to be hooked up to each other. But the nice feature here is that we can link both emitters into the one particle object.

Select *Open Window > Relationship Editors > Dynamic Relationships*, which is an editor where we can hookup dynamic relationships between objects, fields, emitters, and collisions (Fig Q). This is the true beauty of Maya – it's modular nature and complete customizability to nearly any situation.

In the Selection Mode, highlight Emitters, and then with particle1 selected, you'll see emitter1 already highlighted in orange. Click on emitter2 to link that one to it also. That's it; with a bit of fiddling with each emitter's parameters, you can create a nice animation of the two drops slowly moving towards each other (Fig R & S). The individual particles for each emitter help to create a more viscous look for the individual drops, and when they come close to the other emitter you'll see them slowly pulling on each other to complete the effect.

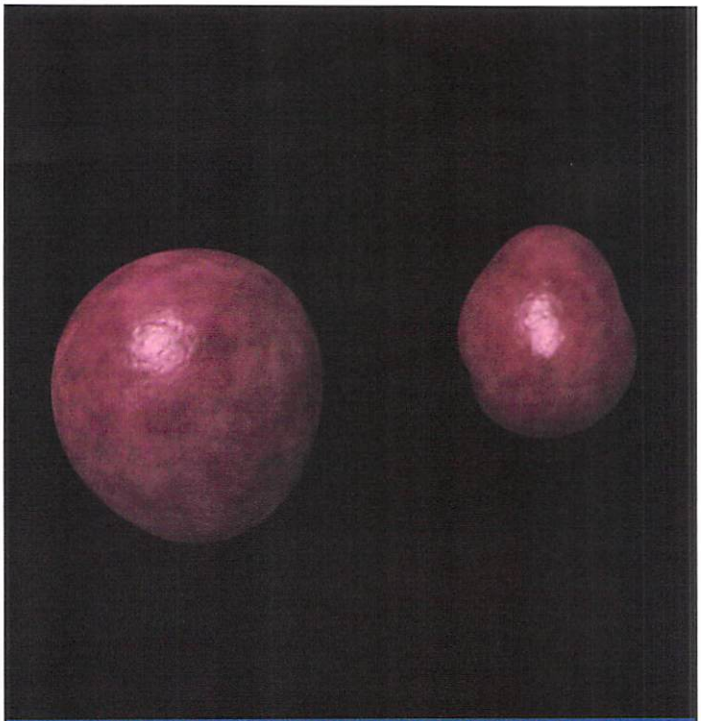


FIG R– A FAR BETTER LOOKING DROP OF KLINGON BLOOD

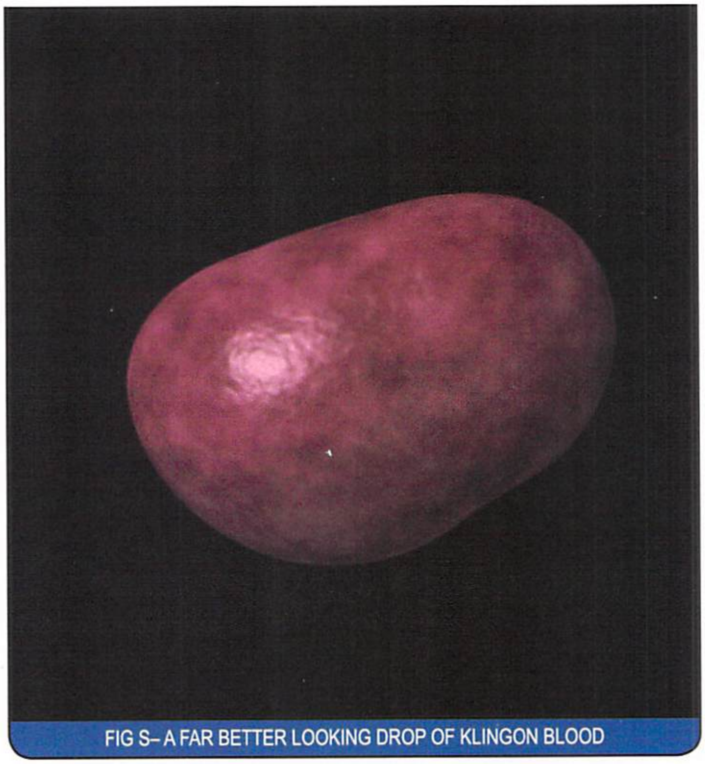
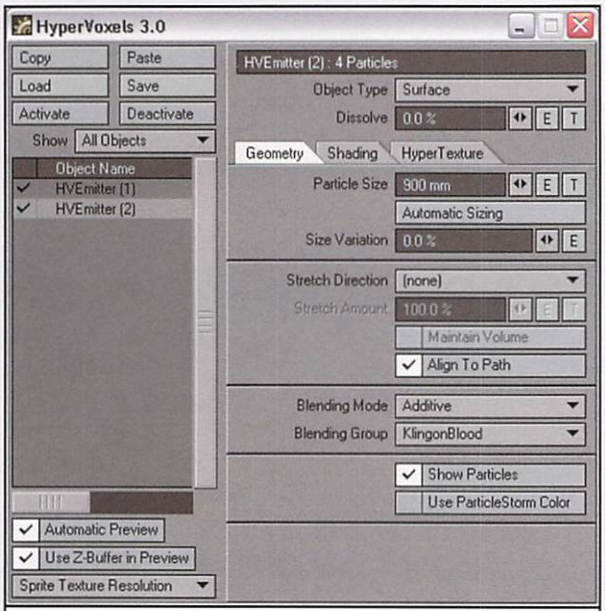


FIG S– A FAR BETTER LOOKING DROP OF KLINGON BLOOD

SEE CONCLUSION ON PAGE 54

*LIGHTWAVE– CONTINUED FROM PAGE 51*



Show: All Objects

Object Name
✓ HVEmitter (1)
✓ HVEmitter (2)

☑ Automatic Preview
☑ Use Z-Buffer in Preview

HVEmitter (2) : 4 Particles
Object Type: Surface
Dissolve: 0.0 %
Particle Size: 900 mm
Size Variation: 0.0 %
Stretch Direction: (none)
Stretch Amount: 100.0 %
☐ Maintain Volume
☑ Align To Path
Blending Mode: Additive
Blending Group: KlingonBlood
☑ Show Particles
☐ Use ParticleStorm Color

FIG 17– MAKE SURE BOTH EMITTERS HAVE THE SAME BLENDING GROUP

## 8. ONE STEP FURTHER

Let's take this technique one step further. Another good way you could improve upon the technique is to use separate emitters for each blood drop, giving you complete control over the movement of the two coming together. This also has the advantage of making each droplet look more authentic, since the individual particles of each emitter will join together and break up the circular shape we had before.

First of all, either create a second emitter with the FX_Browser again, or clone the first one *(Items > Add > Clone)*. Move it away from the first and, if you want, animate the two emitters driving towards each other. I found that reducing the particle Generator Size helped to contain the individual particles of each emitter close to the center.

Back in the Hypervoxels panel (Fig 17), in a somewhat similar way to Maya's dynamic relationship editor, we're going to link the particle shader to the second emitter. You'll see HVEmitter2 in the list on the left, and it's literally as easy as hitting Activate. An easy way to transfer over the same settings as the previous emitter is to simply click Copy and then Paste from the first to the second. Alternatively, you can save the shader and reload it.

The important part here, however, is to create a Blending Group. This tells LightWave to include any emitters in the group for blending together. It's actually quite flexible, allowing you to specify additive, subtractive, or intersection. Create a new group and set it to additive, then make sure the other emitter is also included in that group. With this set, do a test render and hopefully everything should be working nicely (Fig 18 & 19).

As you can no doubt see, this method works so much better than trying to control everything with the one emitter, and gives for a nicer looking result.

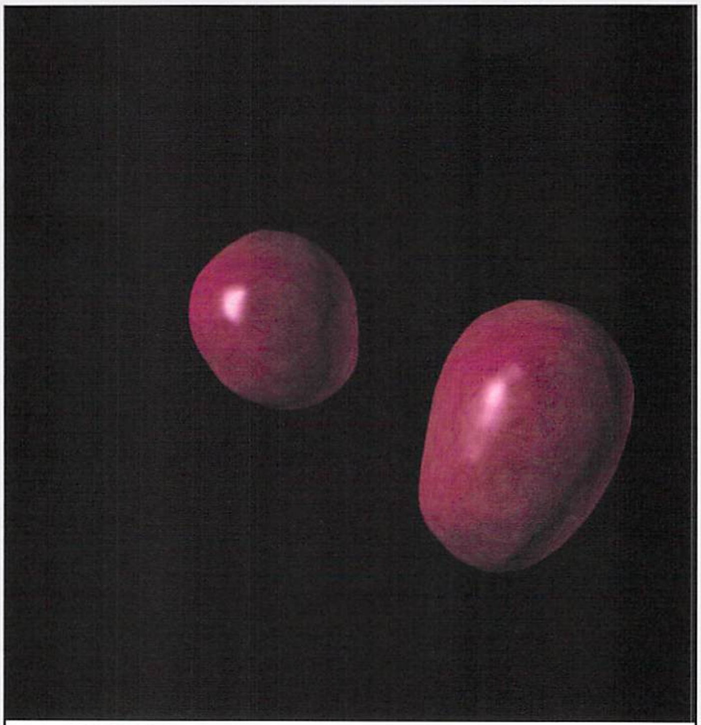


FIG 18– HAVING TWO EMITTERS GIVES YOU FAR MORE CONTROL

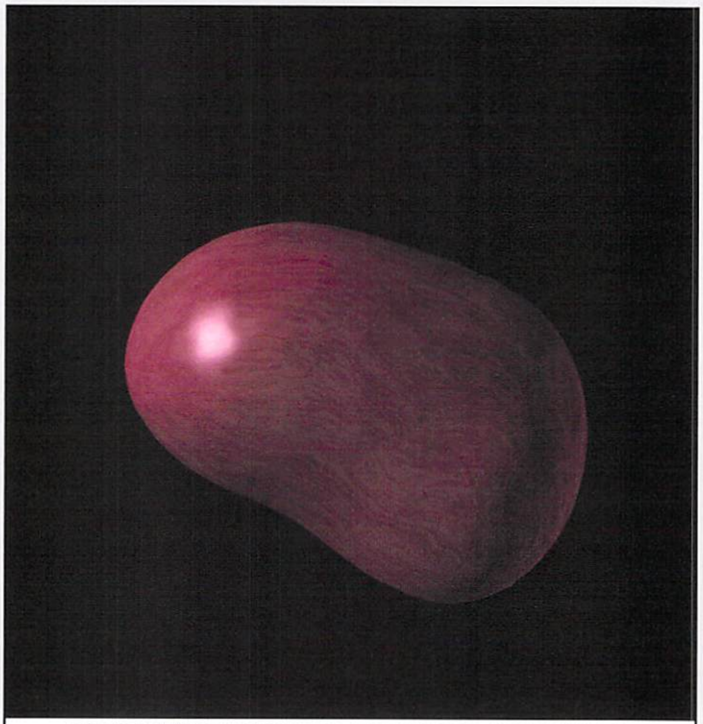
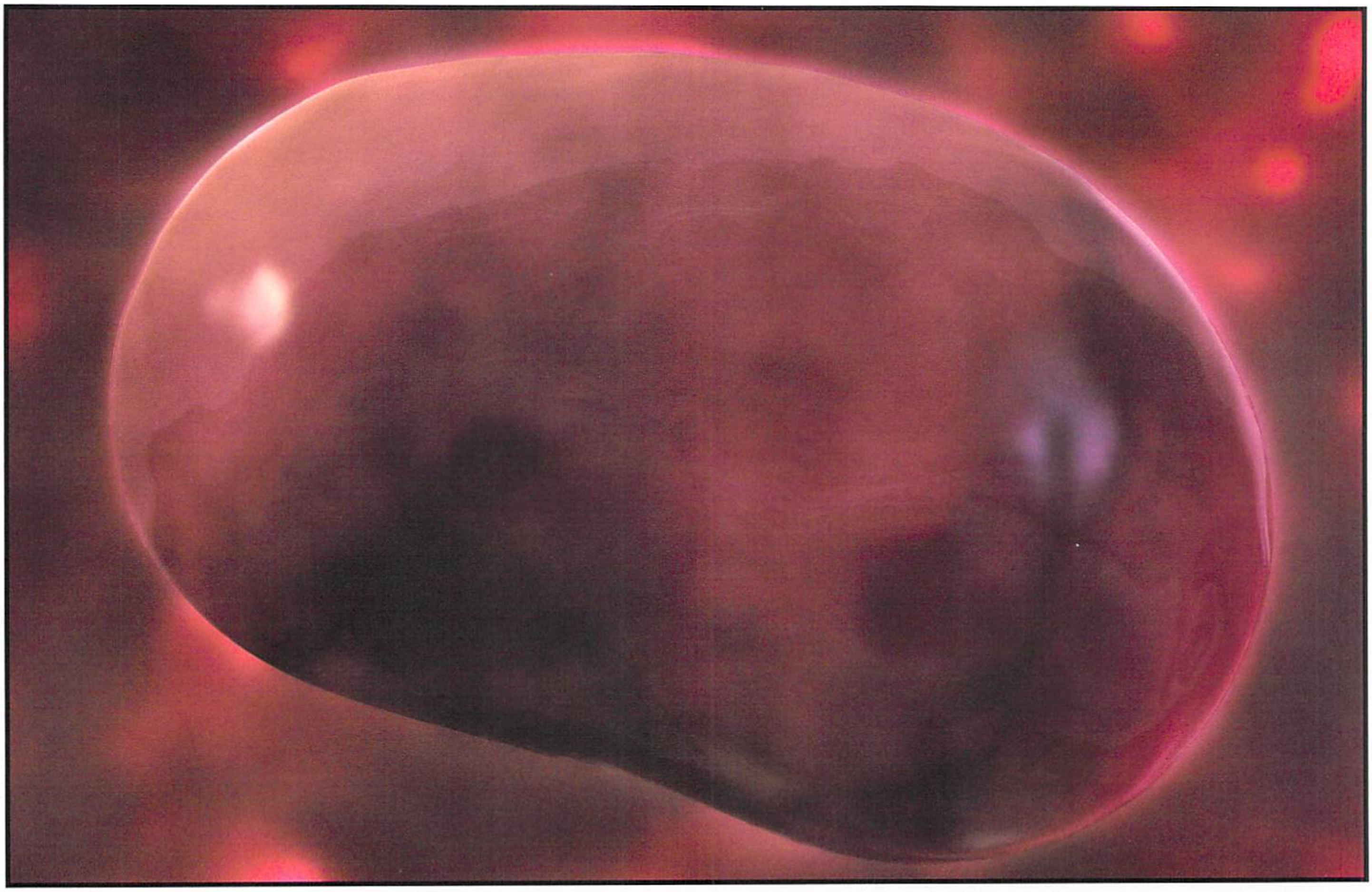


FIG 19– HAVING TWO EMITTERS GIVES YOU FAR MORE CONTROL

*SEE CONCLUSION ON PAGE 54*

MAYA & LIGHTWAVE – CONTINUED FROM PAGES 52 & 53



## CONCLUSION

So there you have it. I was surprised to find out as I wrote this tutorial that there seemed to be more tools/windows to explain to new users of Maya (e.g. Outliner, Hypershader, Attribute Editor), whereas LightWave was a little more straightforward (using only the Hypervoxels for most of the tutorial). In the end, though, I would say that an experienced user in either package would complete the effect in roughly the same time, and I couldn't recommend either package over the other. Ultimately, they all do the same things; it's just personal preference as to which 3D package you prefer.

For the purpose of this tutorial, we just aimed to make a single frame render, so I didn't touch on any factors concerned with making it look good when animated. I encourage you to try this now, if you've completed the tutorial, and expand your learning of the program's features.

There are many ways you could improve upon the effect, and I hope you'll continue to go beyond the scope presented here. Perhaps try using a better reflection map, or set up a proper environment to reflect. Experiment with the material settings, make the surface more watery, maybe add an oily fresnel effect, or give the particles random sizes ... Similarly, why not try compositing the blood into live-action footage? Perhaps film one of your friends pretending to be a Klingon floating against a makeshift blue screen. The possibilities are endless.

I hope this tutorial has been useful as a starting point for crossing over into either piece of software. You've gotten over the hard part and taken that inevitable first step. Just remember – there are some people who put too much emphasis on this or that particular piece of software, claiming it to be superior to others.

But, in the end, it's not the tools that make the artist, and a brush is only as good as the hand that wields it!

**ALEXANDER SHAREEF** HAS BEEN A PROFESSIONAL VISUAL EFFECTS ARTIST FOR THE LAST THREE YEARS, AND CURRENTLY WORKS AT BIOWARE CORP. IN CANADA AS A LEAD VISUAL EFFECTS ARTIST ON AN AS-YET-UNANNOUNCED PROJECT. HE WAS INSPIRED TO ENTER INTO 3D GRAPHICS AFTER WATCHING *BABYLON 5*, AND IS COMPLETELY SELF-TAUGHT. THOUGH HE HAS USED ALL THE MAJOR 3D APPLICATIONS, INCLUDING MAYA, 3DS MAX, AND HOUDINI, HE PREFERS THE ONE HE STARTED OUT WITH, LIGHTWAVE. HE MOVED TO CANADA FROM ENGLAND WITH HIS WIFE, AND IS FASCINATED WITH ANCIENT CULTURES SUCH AS ANCIENT EGYPT.

BY BILL BLAKESLEY

# UV MAPPING A COMPLEX CHARACTER

This is my first article for HDRI 3D. I'm very excited about contributing to a magazine that concentrates on real production solutions for those of us in the trenches.

That being said, if you regard canned demos with skepticism, then read on. I'm going to deal with the nitty gritty of UV mapping in SOFTIMAGE|XSI.

UV mapping can be a difficult process for complicated characters and objects. The arbitrary topology of polygons is great for efficient modeling, but can create a real nightmare for the texture artist. I'm going to go through the process of mapping a full character while highlighting most of the cool features that the SOFTIMAGE|XSI Texture Editor (TE) has to offer.

First, I'll point out a few rules of thumb to keep in mind when UV mapping. Number one: Don't get too precise about every little point. It's best to be flexible in the early stages because most of your initial mapping will be combined in unforeseen ways and you can waste a lot of time tweaking too early. Number two: It's often a combination of tools that produces a good texture layout. Many times the first result of a tool isn't the best and we're too quick to hit the old (Ctrl – Z) and decide the tool isn't up to snuff. I'm going to include examples where several iterations and combinations of tools create great results quickly. Number three: Speed is obviously important. Be open to experimenting with the latest tools even when you have a decent workflow established. Many of the these tools can decrease your production time in a huge way if you spend some time getting to know them.

To get started, I'll include a few quick notes about the mapping workflow in SOFTIMAGE|XSI. The program synchronizes component selections in the 3D viewports with texture sample selections in the TE. This is a great feature, because you can make selections in the TE or use all the best selection methods for points, polygons, edge loops, range selection, etc., in the camera view. Whether selecting regions of geometry in viewports or sample regions in the TE, you can then create a sub-projection for that region. Sub-projections are represented by a texture support object that can be adjusted in the viewports. The resulting sample regions in the TE can then be merged with other sample regions to create a full texture layout. In this way, you can use the projection method that works best for each area of geometry and then piece it all back together. It's also a good idea to create polygon clusters for appendages and cohesive regions of geometry during modeling or before you start the mapping process. Using these clusters as selections can save lots of time.

Now, let's get into mapping. First, we'll apply a phong material to the dragon mesh, attach the default image, and use an XZ planar map to get something going. Next, we'll set one of our views to the TE *(Figure 1)*.

We'll begin breaking up the results of the initial planar projection by selecting the polygons on the top of the head and using a XZ world aligned planar sub-projection in the TE *(Figure 2)*. There are a few overlapping edges in the creases, but we'll clean that up later. Next, we'll use a few "best fit" planar projections for the sides of the head. "Best Fit" sub-projections are extremely useful for getting quick projections that are automatically oriented over the target area. Generally, the default orientation is good, but the support can be manipulated further for better results. Our sample region is rotated at an odd angle,

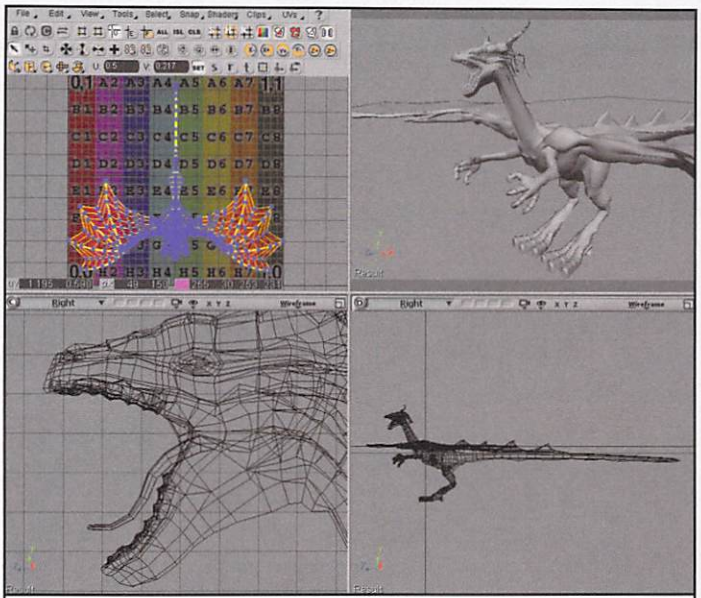


FIGURE 1– FIRST XZ PLANAR PROJECTION

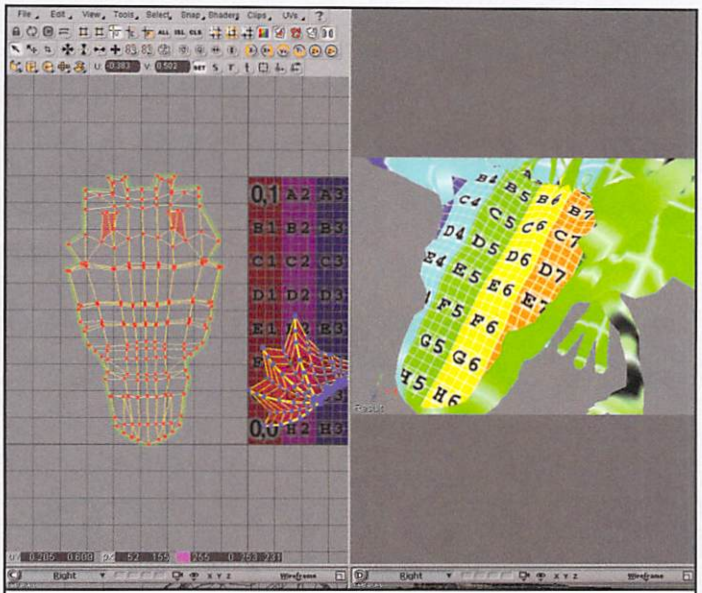


FIGURE 2– XZ WORLD ALIGNED SUB-PROJECTION

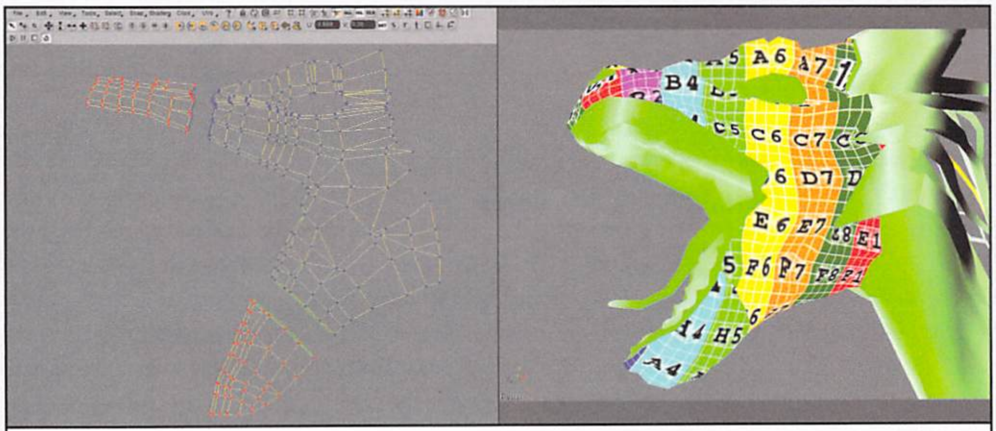


FIGURE 3– A COUPLE OF "BEST FIT" PLANAR SUB-PROJECTIONS ARE USED FOR THE SIDE OF THE HEAD

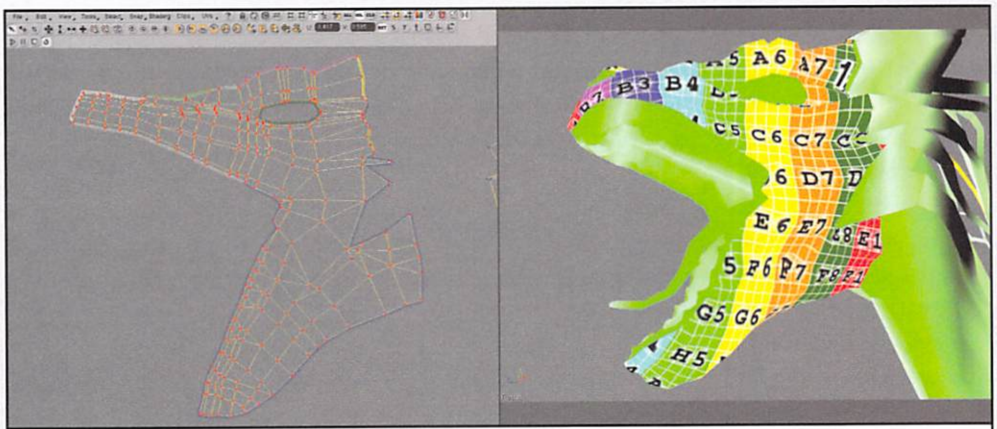


FIGURE 4– THE REGIONS ARE HEALED TOGETHER USING THE "ISLAND HEAL TO PICKED" TOOL

so we'll rotate the texture support in the camera viewport to get better alignment in the TE (Figure 3).

In addition to projections, the TE contains many great tools for manipulating samples. We'll use several here. The first is Island Selection. This toggle selects contiguous sample points by selecting one or more components in a connected sample region. It can be toggled on and off by pressing "I" with the cursor over the TE viewport. As always, getting to know the hotkeys in the TE will speed your workflow up tremendously, and many hotkeys are shared with similar functions throughout SOFTIMAGE |XSI. We'll select the jaw island we just created and use the "Island Heal to Picked" (>) tool to heal the jaw region back to the side of the head. The region rotates, translates, and heals in one step. Most often we'll toggle on the scale option in the supplied property page. We'll repeat this process for the upper jaw *(Figure 4).*

Another useful feature is the Relax UVW tool. Relax attempts to adjust the area of the samples in the TE to be closer to the physical geometry. This reduces distortion caused by the mapping process. Our eyelid region has some overlapping samples, so we select the points and press (Ctrl – R) to relax them. Relaxing samples after projection can be very effective, and using it once we've got larger islands glued together can fix a lot of problems all at once. To correct overlaps that don't relax well, we can move the samples in the TE with (Shift – m) to keep the samples together.

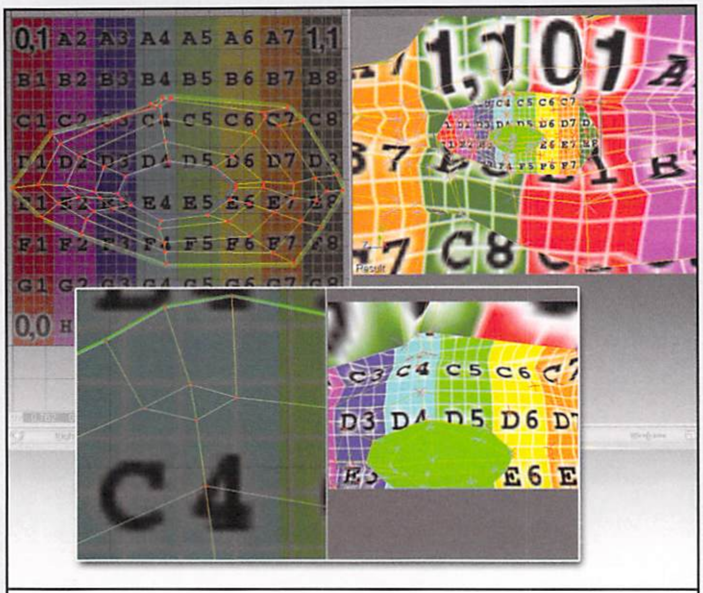


FIGURE 5– MOVE POINT TOOL USING CAMERA VIEW AS A GUIDE

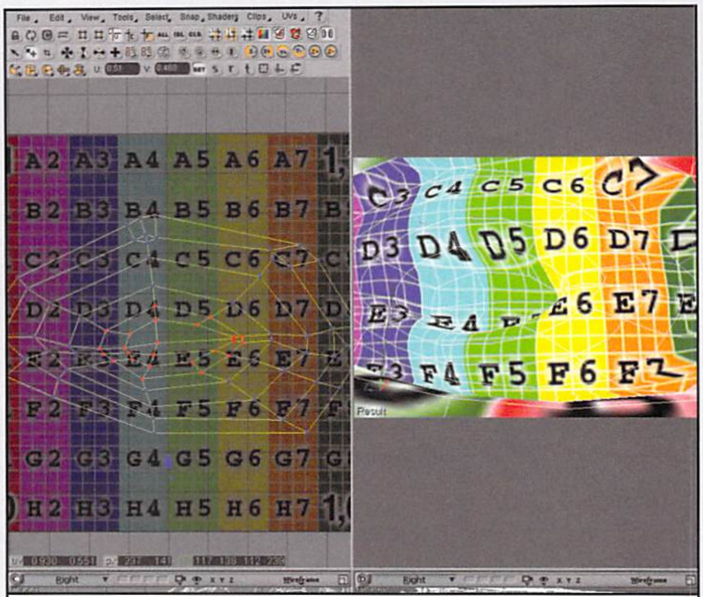


FIGURE 6– PLANAR SUB-PROJECTION USED FOR THE EYE

Let's move on to the eyelids using a "Best Fit" planar sub-projection *(Figure 5)*. Everything looks good except for a spot on the upper border. Using the camera viewport as a guide, we'll fix this using (Shift – m) to rearrange the points. We repeat this process for the eye socket, apply the Relax tool to the result, and use the "Island Heal to Picked" tool to merge the socket island into the center of the eyelid island. Figure 6 shows the result with one level of subdivision surface enabled. We repeat this process to heal the eyelids back into the head region.

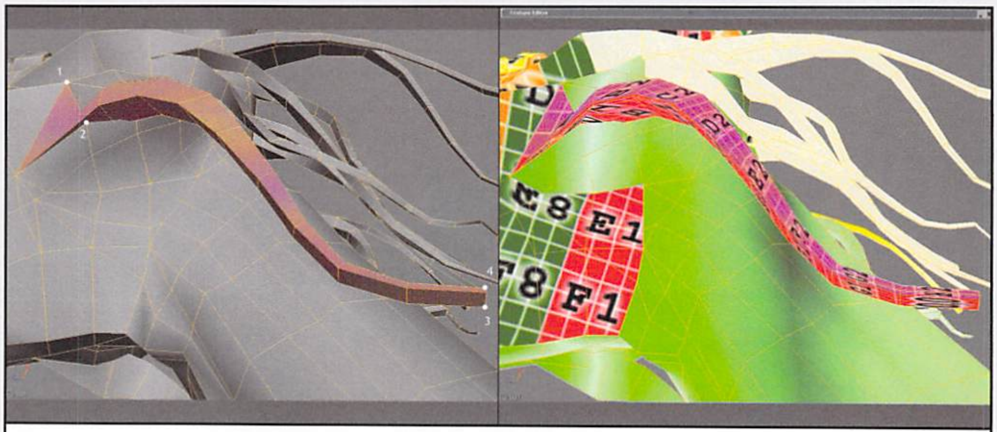


FIGURE 7– TWO ROWS OF POLYGONS ARE SELECTED IN THE CORRECT ORDER

Now let's tackle the tentacle-like projections on the back of the head. Until recently, this area of geometry would have fit into that "What the hell was I thinking?" category. Not only do the tentacles undulate in space, they twist down the length, making the polygons hard to select. This was previously a major time commitment to a very small portion of the model, but now we have one of my favorite tools in the TE, the Contour Stretch sub-projection. As the name implies, this projection type stretches like a rubber sheet over a roughly rectangular selection of polygons. The new Range Selection feature will also make selecting two sides of the tentacle a snap.

Since the tentacles form a cylindrical patch, we'll leave out a row in our selection and pick it up when we're done. The Contour Stretch tool requires discreet borders to work correctly. We quickly define our polygon region, click the tool using "Walking on the Mesh," and then right-click in a viewport to end the pick session. The tool will do its best to create a good layout without user input, but in this case it failed. Let's try again. This time we'll define the boundaries by clicking the points at each corner of the rectangular region *(Figure 7)*. Now we've got a great layout in the TE. It's important to click the boundary points in the right order so that the tool knows which corner comes after the next. Also, sometimes it's easier to visualize the corners in wireframe. A handy keyboard shortcut in the TE is (Ctrl – Shift – A) to deselect all. It's often hard to see what's selected in a complicated mesh and time consuming to deselect samples with the rectangular marquee.

For the last row, we'll use the same tool. Since this region is close to a perfect rectangle, the region is laid out automatically. Now we'll use a few more tools to get these regions healed. We can't use "Island Heal to Picked" because our row connects to both sides of the main tentacle island and we'll get overlapping polygons in the result. Projections often rotate the samples at incorrect angles. In this case, our row is rotated 90 degrees.

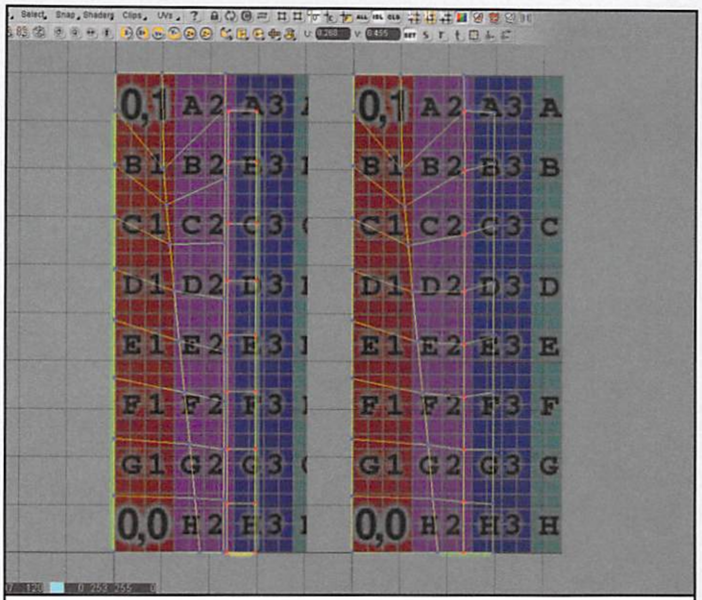


FIGURE 8– THE REMAINING ROW IS PICKED UP AND HEALED TO THE MAIN REGION

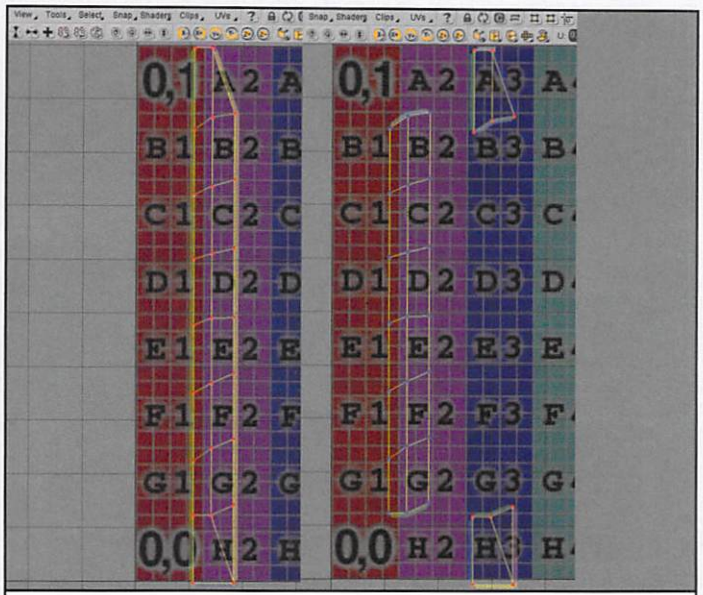


FIGURE 9– A LESS THAN PERFECT CONTOUR STRETCH PROJECTION IS SALVAGED

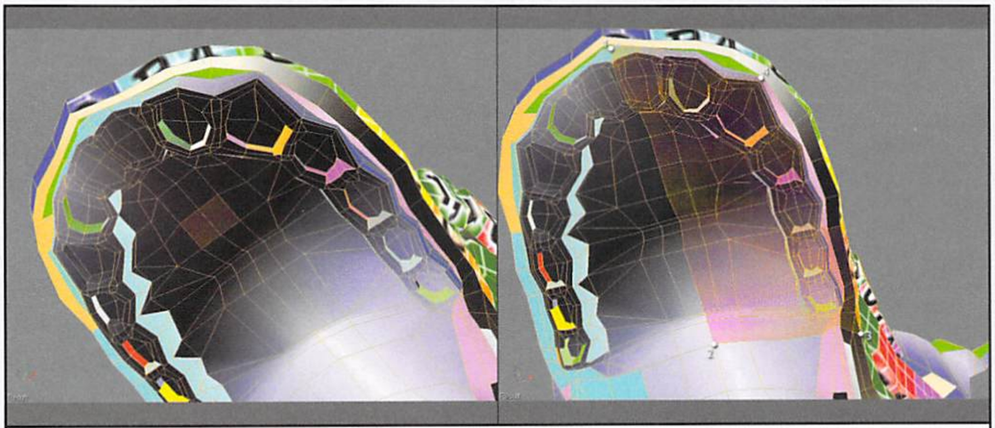


FIGURE 10– GROWING A SELECTION AND PICKING THE CORNERS FOR THE CONTOUR STRETCH TOOL

We'll correct this by pressing the "r" key once to rotate the region 90 degrees clockwise. The colored connectivity tags on the region boundary give us a good visual indicator as to which edges match up. We use standard transform keys to scale and translate the row right up against the boundary of the main tentacle region. Now, we can select the boundary points to heal and press (Ctrl – Shift – (number pad) +) *(Figure 8)*.

As you have probably noticed, picking the borders of a region can be difficult with twisting or complex geometry. Sometimes the Contour Stretch tool creates less than perfect results, but we can still use them *(Figure 9)*. The main tentacle island looks good except the ends have overlapping points. Instead of starting over, we can isolate the incorrect rows of polygons and use "Best Fit" planar projections or another Contour Stretch projection to get a better layout. Then we can "Island Heal to Picked" these areas back into the main island. To aid in this sort of repair, there is an important difference in the TE between point and polygon selections. In addition to selecting several points at a time, polygon selections only select the samples within them. If you select a region of polygons in the viewports or in the TE and translate it, the region will detach as a separate island. This also works in the TE with the Move tool. So, in the previous operation, if we use polygon selection, we can quickly separate the incorrect regions so they can be re-mapped *(Figure 10)*. In addition, if you have a selection you are trying to re-map and it just won't let go, you can isolate the selection by clicking the "Show Selected" icon in the TE toolbar or use (Shift – h). This tool isolates your selection so it can be moved off of its current location without dragging connected points. To unhide, click the "Show All" icon or (Ctrl – Shift – h) and you'll see that your selection is now an independent island ready for re-mapping.

We duplicate the same process for the rest of the tentacles and horns and then move on to the mouth region. Here we'll use "Grow Polygon Selection" (Shift +) to get the right area defined. We start with two polygons roughly in the center of the area we want to select and then grow them out to get all the folded surfaces of the gums and roof of the mouth. We'll then deselect the rear area to keep it clean and the dragon's right side. We're sticking pretty much to the left side of the head because we'll be using a great UV symmetry script at the end to mirror things over.

Now we'll use the Contour Stretch tool to great effect. We have a roughly rectangular area selected in the roof of the mouth. We use

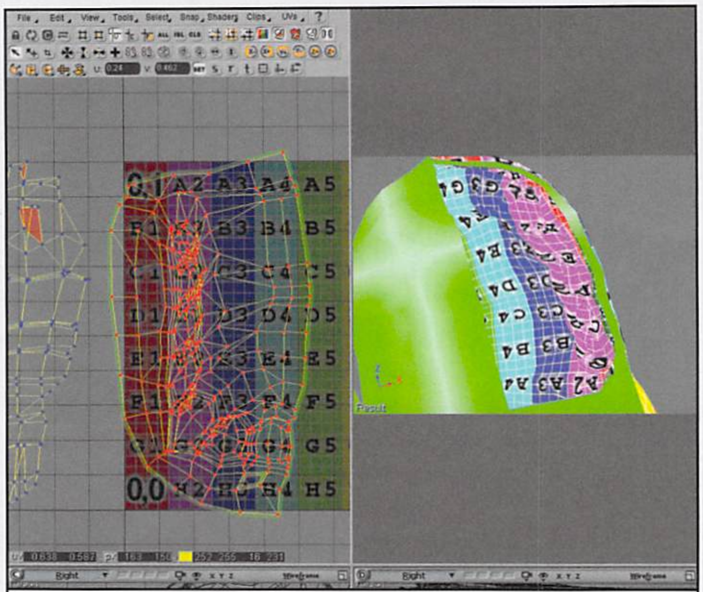

File, Edit, View, Tools, Select, Snap, Shaders, Clips, UVs, ?
Result
Right
Wireframe

FIGURE 11– RESULT OF "WALKING ALONG THE MESH" AND TWO RELAX OPERATIONS

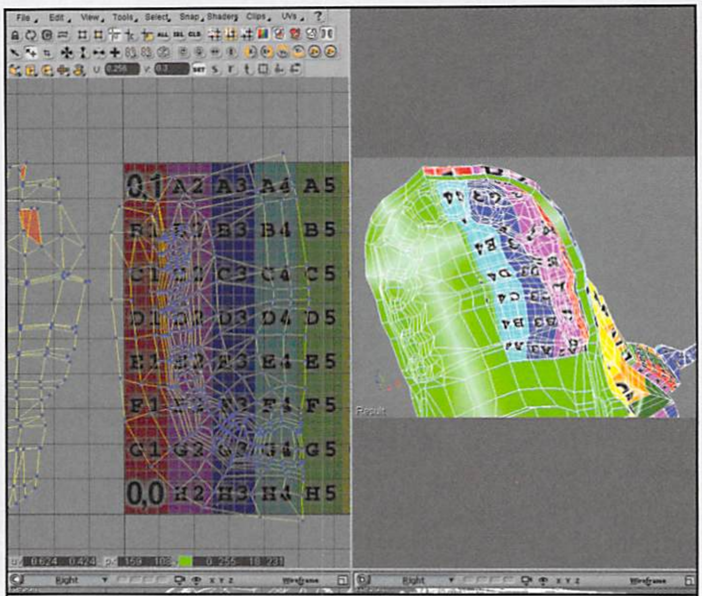

File, Edit, View, Tools, Select, Snap, Shaders, Clips, UVs, ?
Result
Right
Wireframe

FIGURE 12– POINT EDITING USING PROPORTIONAL MODELING

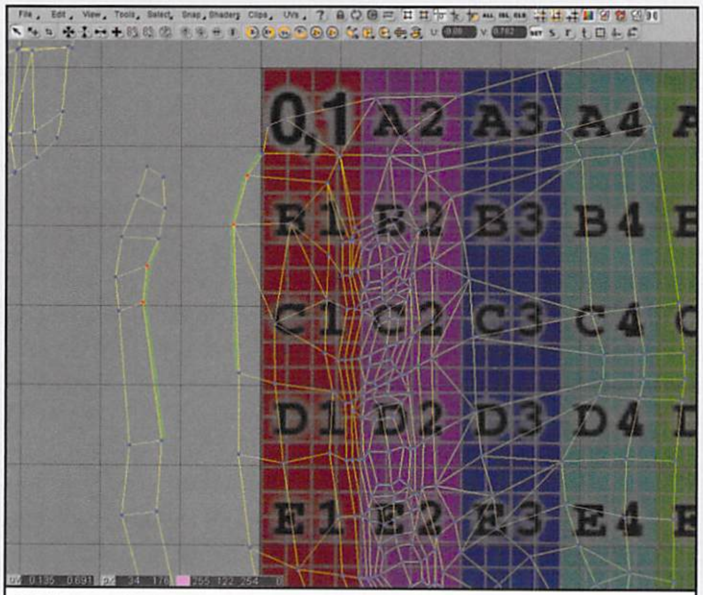

File, Edit, View, Tools, Select, Snap, Shaders, Clips, UVs, ?

FIGURE 13– PLANAR PROJECTION AND POSITIONING THE REMAINDER OF THE GUMS

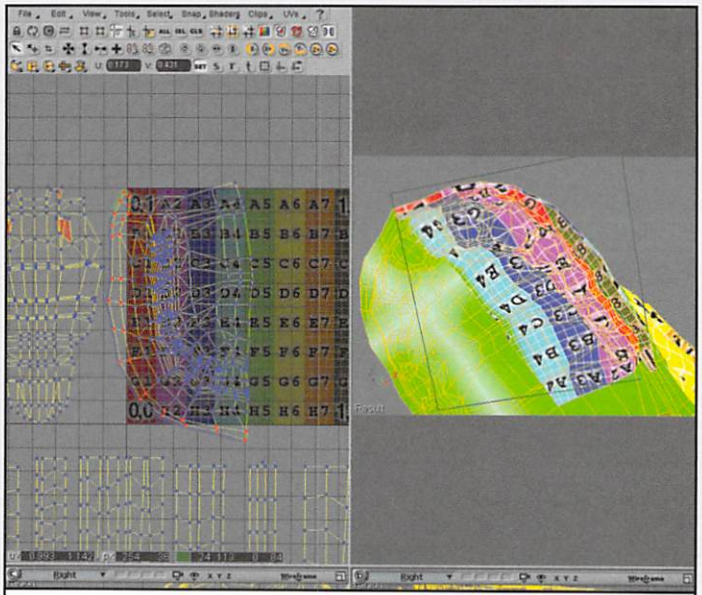

File, Edit, View, Tools, Select, Snap, Shaders, Clips, UVs, ?
Result
Right
Wireframe

FIGURE 14– HEALING PERFORMED ON THE GUMS

"Walking on the Mesh," select the corner points (Ctrl – r) twice to relax a few times, and this is the result *(Figure 11)*. I even missed a few polygons and the result is still pretty good. Impressive. Most impressive. There are some overlapping polygons in some of the tooth sockets, etc., but a few touchups with some localized relaxes and tweaks with the Move tool and it's done. The final step is to get the region back into its original U shape. We'll enable proportional modeling and use the Move tool to shift the front portion over with a nice smooth falloff *(Figure 12)*.

As mentioned before, when using sub-projections to break regions up, the results are often misaligned, rotated, or even flipped so that they don't heal back together correctly. "Best Fit" projections commonly create this sort of problem, but there are several tools to help get things back on track. Using the Rotation Transform is an obvious choice. The "r" key pressed several times is also a quick way of getting selections rotated into position. Flipped islands are common and can be flipped horizontally or vertically using Ctrl (numpad) / and Ctrl (numpad) – respectively. Flipping is often the culprit when getting bizarre results from an "Island Heal to Picked" operation. The colored tabs on the borders of islands help to sort out these problems, but specific attachment points can sometimes be hard to visualize. A good tool to use when trying to find that specific shared point and the direction borders are running is the "Vertex Bleeding" toggle icon in the TE toolbar.

In Figure 13, we've selected the last row of the gums, used a "Best Fit" planar sub-projection, pressed "r" twice, and scaled the selection. Points selected on our new island with the "Vertex

Bleeding" toggle ON automatically selected shared points on the previous island so you can see the connections. Just remember to turn this back OFF, as it can really mess things up. We heal the regions together and we're done with the roof of the mouth *(Figure 14)*.

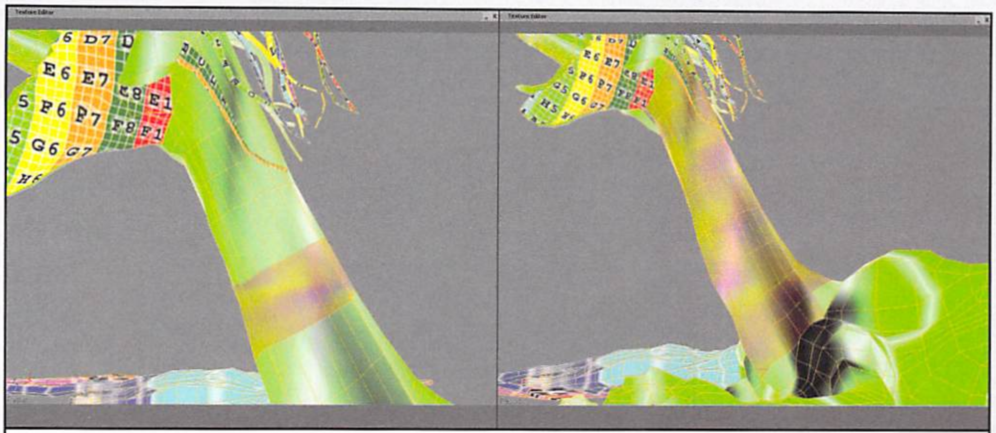


FIGURE 15– GROWING POLYGONS MAKING UP THE NECK

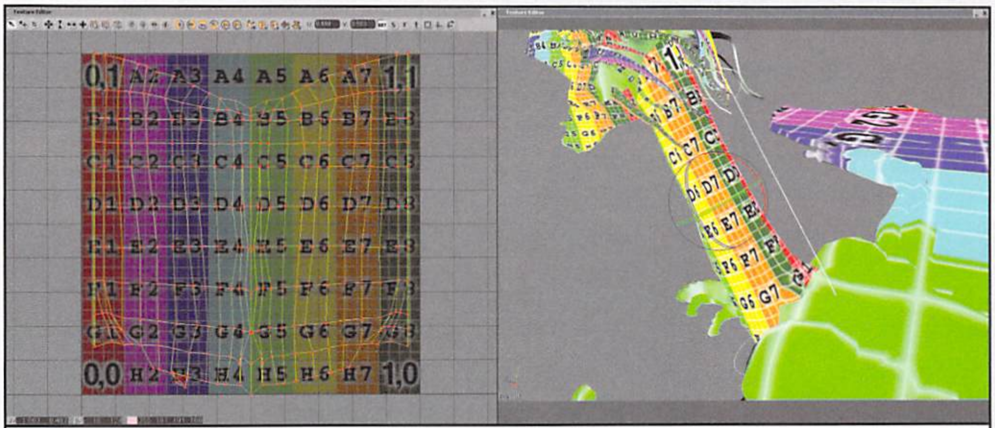


FIGURE 16– CYLINDRICAL PROJECTION USED FOR THE NECK. THE SUPPORT IS USED FOR ALIGNMENT

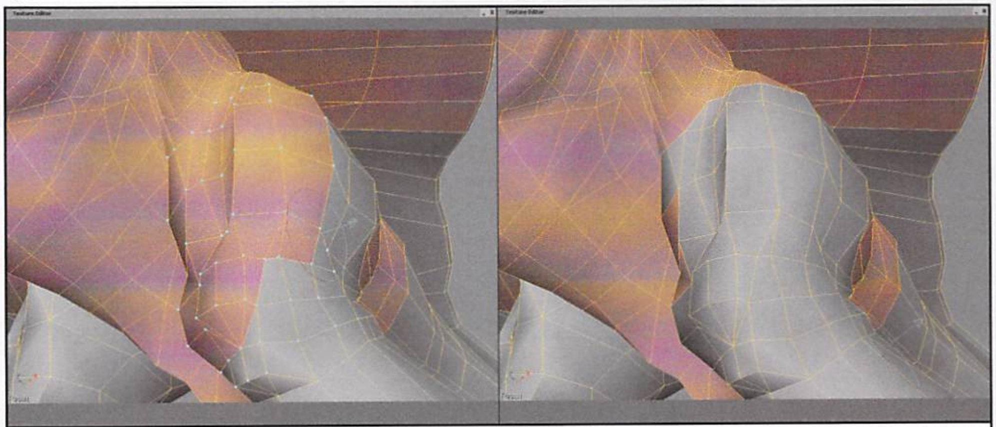


FIGURE 17– F11 PAINT POLYGON TOOL USED TO REMOVE UNWANTED POLYGONS FROM A SELECTION

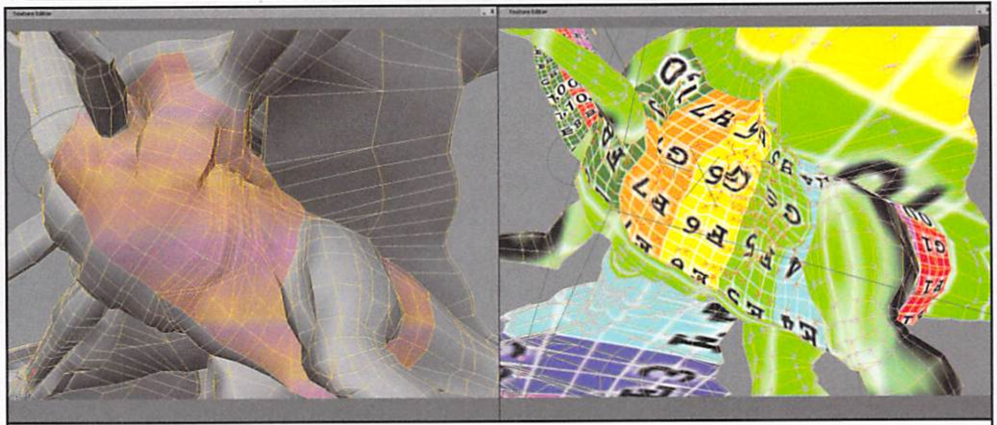


FIGURE 18– CONTOUR STRETCH SUB-PROJECTION USED ON THE TORSO

Now let's jump into some of the larger regions of the body. I'm not using previously saved polygon clusters in case you're the poor sap in charge of texturing a character that doesn't have any. We'll select a polygon ring in the center of the neck using range selection. We'll grow these polygons out a bit and deselect the unwanted ends *(Figure 15)*. Next, we'll use a "Best Fit" cylindrical sub-projection and adjust the texture support in the camera viewport *(Figure 16)*. We vertically scale the result and move it off to the side.

The dragon has a fairly complicated torso. To get the selection started, we'll select a single polygon in the ribs region and grow this selection out. To clean up this selection, we'll use the Paint Polygon tool by pressing F11 while in Polygon Component mode. Using the right mouse button, we deselect the upper legs, portions of the wing, and other unwanted polygons to form a roughly rectangular area *(Figure 17)*. Just in case the roof of the mouth wasn't impressive enough, let's use a Contour Stretch projection on this region. We'll need to select the corners to get a good result *(Figure 18)*. A couple of relaxes and a few move point tweaks and we're almost done with the torso. Our nolcon image shows that the UV flow is pretty good except under the arm *(Figure 19)*. A really quick way to correct this problem is to select the distorted polygons, use a "Best Fit" planar projection, and "Island Heal to Picked" to merge them back in *(Figure 20)*. We can use this method to spot correct any area that needs some extra work.

Before we move on to the appendages, let's select the half of the body we're not concentrated on and most of the wings. We'll create a cluster, press Enter to pull up the Cluster Property page, and rename it to hide. Now, press the "h" key and hide the cluster. Anytime we want to add or subtract from this cluster we can select some polygons, (Ctrl – click) the hidden cluster, and click the + or – button in the edit panel. This gets a large portion of the character out of the way so we don't keep running into it with the camera. Clusters are a great way to save collections of polygon selections for later use. If we select a cluster and (Alt – right-click) and select members/components, the components that make up the cluster will be reselected. We can then add or subtract the polygons we need for a particular task.

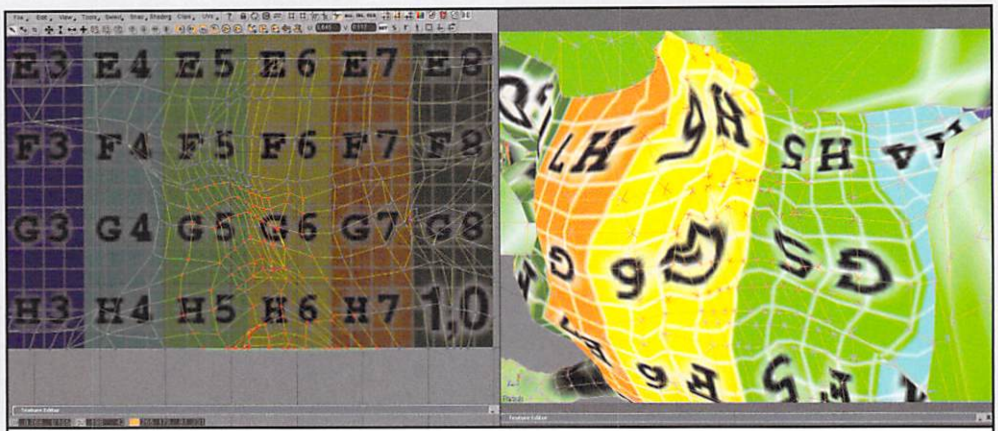


FIGURE 19– AN AREA OF DISTORTION TO BE FIXED UNDER THE ARM

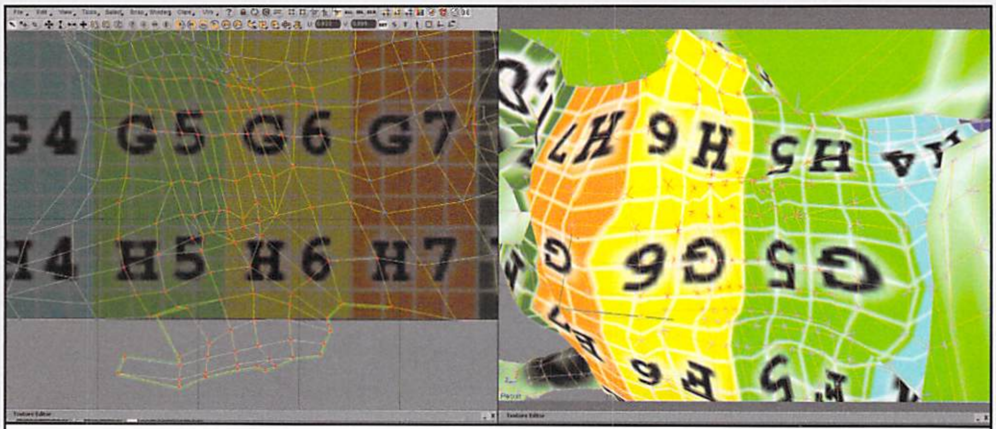


FIGURE 20– THE AREA IS FIXED USING A PLANAR SUB-PROJECTION AND "ISLAND HEAL TO PICKED"

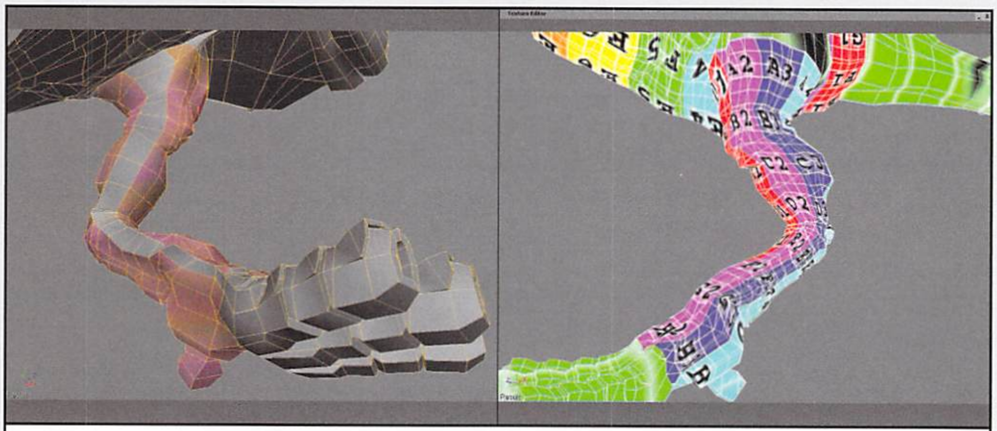


FIGURE 21– CONTOUR STRETCH SUB-PROJECTION USED ON THE LEG

Now we'll select a rectangular patch on the leg by growing polygons and cleaning up the result like we did on the neck. We'll deselect a row of polygons running down the inside of the leg and use the Contour Stretch tool *(Figure 21)*. As usual, this tool takes a very rough rectangular patch and does a great job. We'll run the same process on the row we left out and heal them together *(Figure 22)*. The ankle region is a good place to make a break to reduce distortion, so we'll select out the bottom of the region in the TE using polygon selection, move it down, and relax the two regions separately *(Figure 23)*. Looking over the leg, the knee needs some work. Let's select out the polygon rows making up the knee region and use a cylindrical projection on it. We adjust the projection in a viewport so that the seam is consistent with the rest of the leg. Then we scale and move the region so that it overlaps the lower portion of the leg and heal them together *(Figure 24)*. After correcting some overlaps in the TE, we're ready to finish off the top of the leg and re-map the claw projections. We'll select the top of leg and apply a "Best Fit" planar projection *(Figure 25)*. The Relax tool is great at fixing regions that have a lot of stretching at the edges. We'll rotate the planar projection a little to the left to favor the skin fold and then use the Relax tool *(Figure 26)*. Now we just have to tweak one point and heal this section to the main leg region.

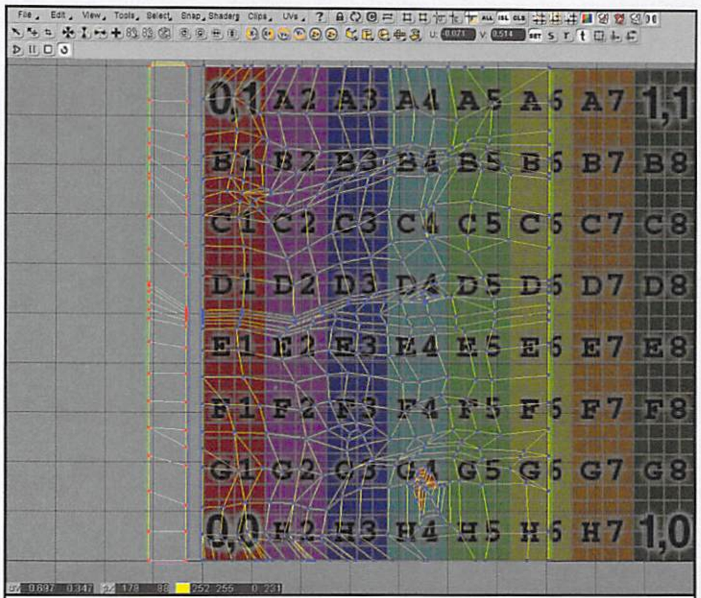


FIGURE 22– EXTRA ROW READY TO BE HEALED

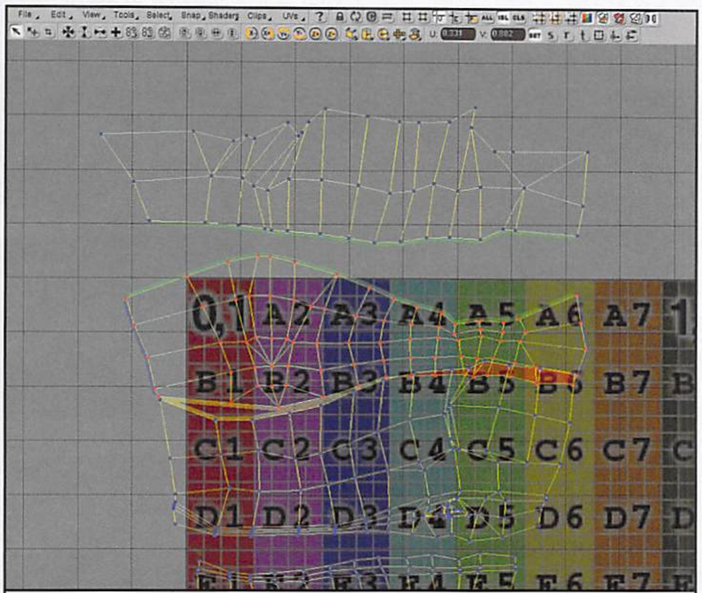


FIGURE 24– KNEE AREA IS ADJUSTED WITH A CYLINDRICAL PROJECTION AND HEALED BACK IN

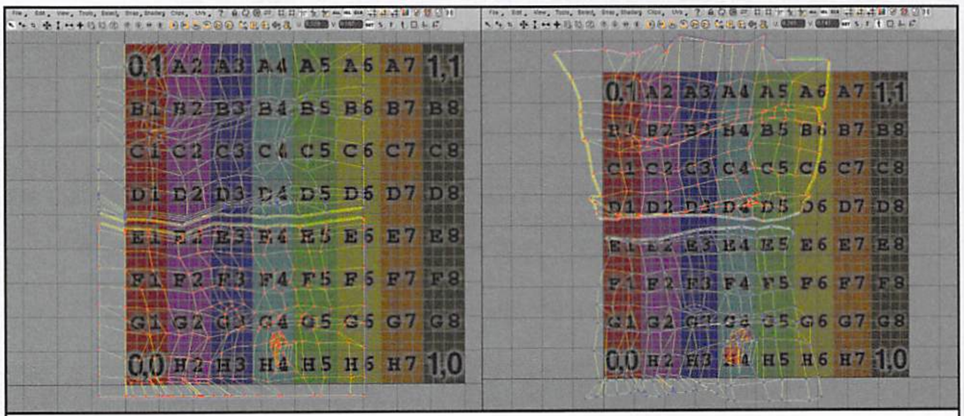


FIGURE 23– THE LEG ISLAND IS BROKEN INTO TWO PIECES USING POLYGON SELECTION AND RELAXED

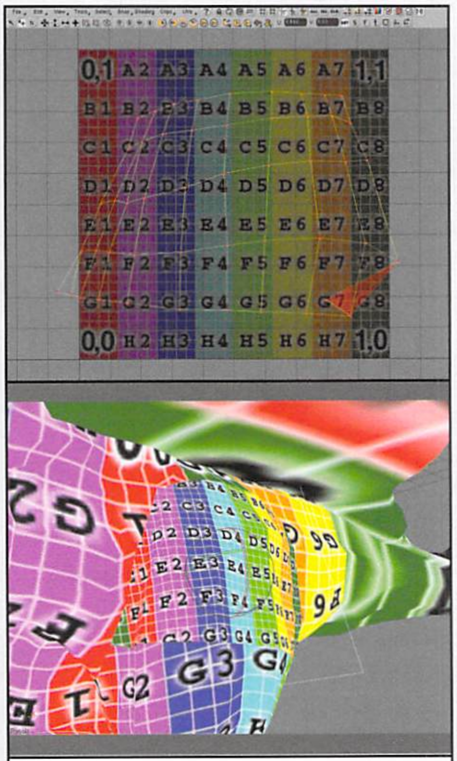


FIGURE 26– THE PLANAR MAP SUPPORT IS ROTATED SLIGHTLY TO THE LEFT AND THE REGION IS RELAXED

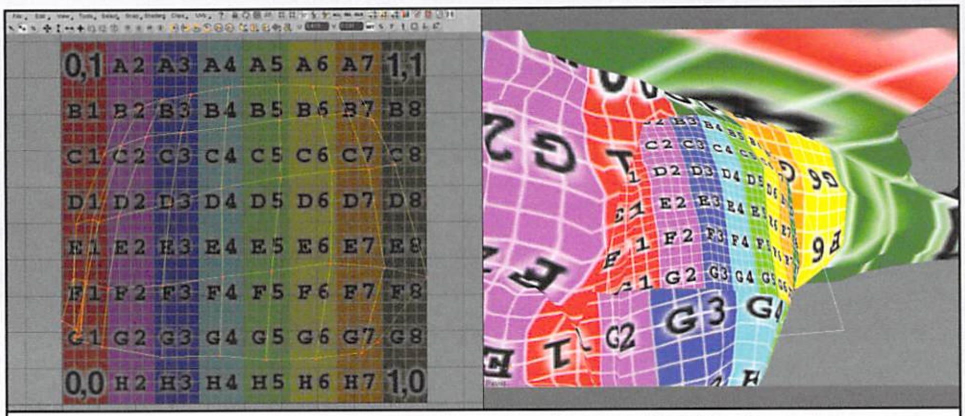


FIGURE 25– THE TOP OF THE LEG IS “BEST FIT” PLANAR MAPPED

Next, we'll use Contour Stretch projection on the first claw region. Once we have these areas laid out, it's not very clear how they fit together. Here we can enable Vertex Bleeding to clearly see the contact points *(Figure 27)*. We repeat the process on the next claw. Generally, the default type of Contour Stretch projection called "Walking Along the Mesh" works the best, but there are instances where "Regular Quads" works better *(Figure28)*.

Let's move on to the feet. We'll start with a cylindrical projection on the big toe *(Figure 29)*. We've got some overlapping polygons because the scales have been included in the model. The best way to handle this sort of thing is to pull out the overlapping polygons, run relax on them, clean up the edges with the Move tool, and heal them back in. In addition to this, we'll clean up the edges of the holes so that healing is even better. Keep in mind that the points are averaged when healed, so we'll overemphasize the scaling of the polygons on both edges before healing *(Figure 30)*. For the tip of the toe, we'll use a "Best Fit" planar projection, relax, and heal it back to the main toe region.

This is a good time to bring up repeating elements. If you are modeling and texturing your character, you can save a lot of time by jumping into the texture process a little earlier. SOFTIMAGE|XSI has the ability to carry over UV clusters when merging geometry. Now I don't have a problem with most people's toes, but I don't like doing extra work. Ideally we would have textured this toe before duplicating it to form the others. We'll go through that process now. Let's delete the second toe – (Alt – right-click) to extract (keep) the first toe – and move it into place *(Figure 31)*. Now we merge the two meshes, select Merge All Attributes in the property page, and we're done. In the UV map, the first and second toe are perfectly

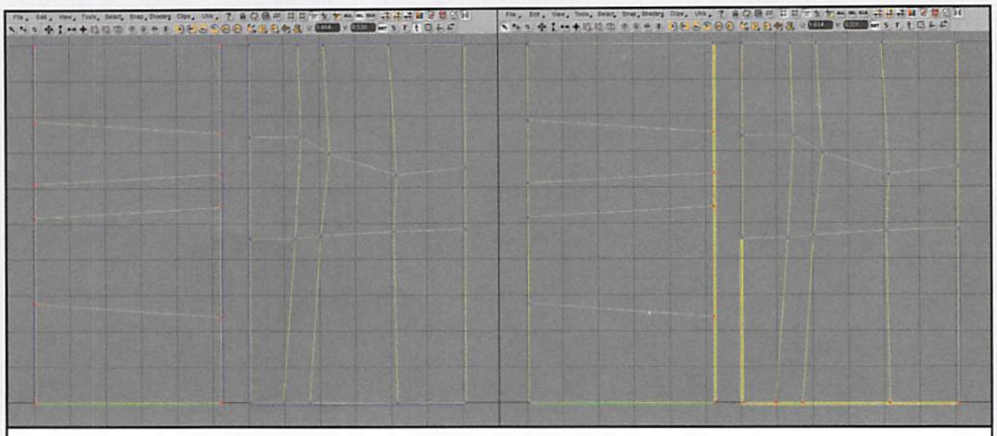


FIGURE 27– VERTEX BLEEDING IS USED TO VISUALIZE THE FIT FOR TWO CONTOUR STRETCH PROJECTIONS

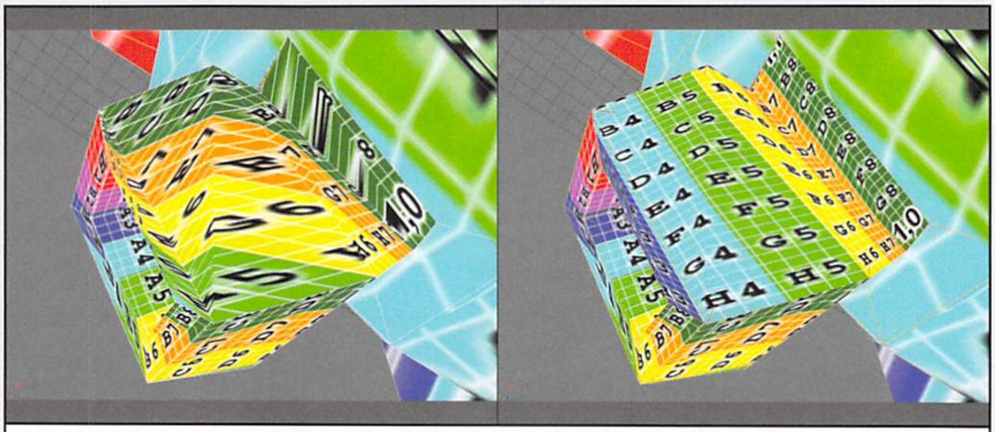


FIGURE 28– THE REGULAR QUADS METHOD WORKS BETTER FOR THIS REGION

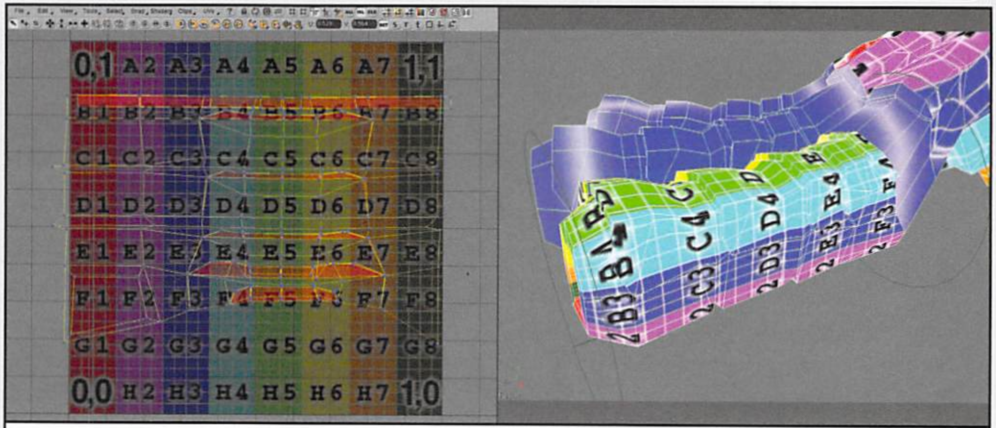


FIGURE 29– A "BEST FIT" CYLINDRICAL PROJECTION IS USED FOR THE TOE

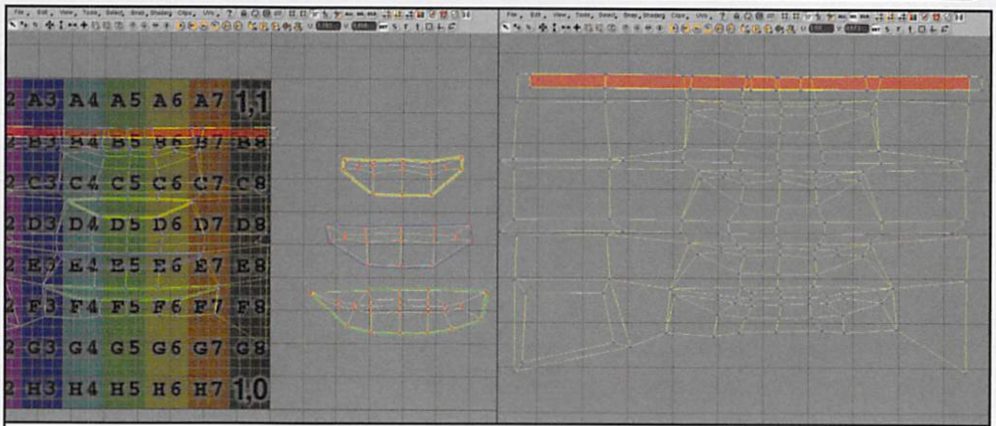


FIGURE 30– THE SCALES ARE SEPARATED, RELAXED, TWEAKED, AND HEALED BACK IN

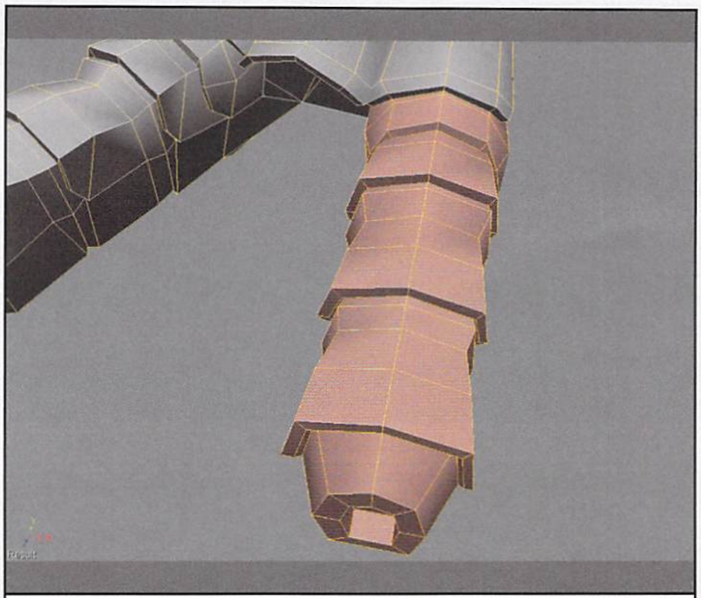


FIGURE 31– THE SECOND TOE IS DELETED, THE FIRST TOE EXTRACTED, ROTATED, SCALED, AND MERGED

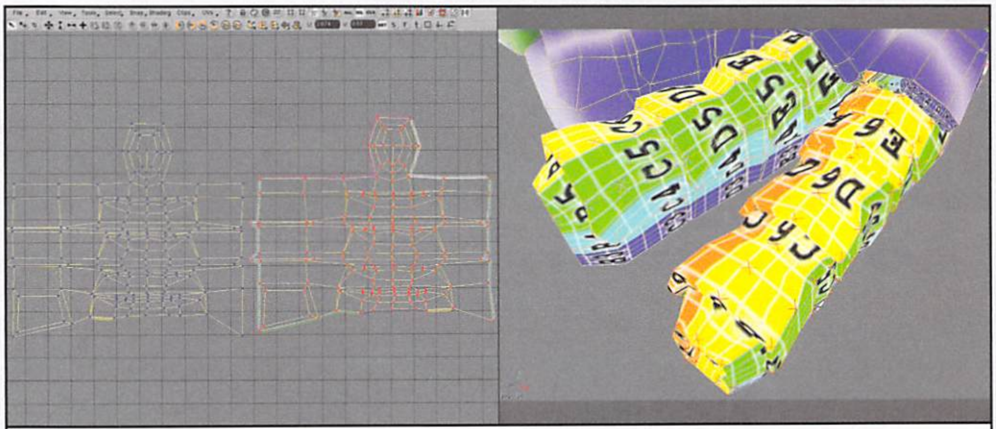


FIGURE 32– THE IDENTICAL UV REGIONS ARE SEPARATED AND A LOT OF WORK IS SAVED

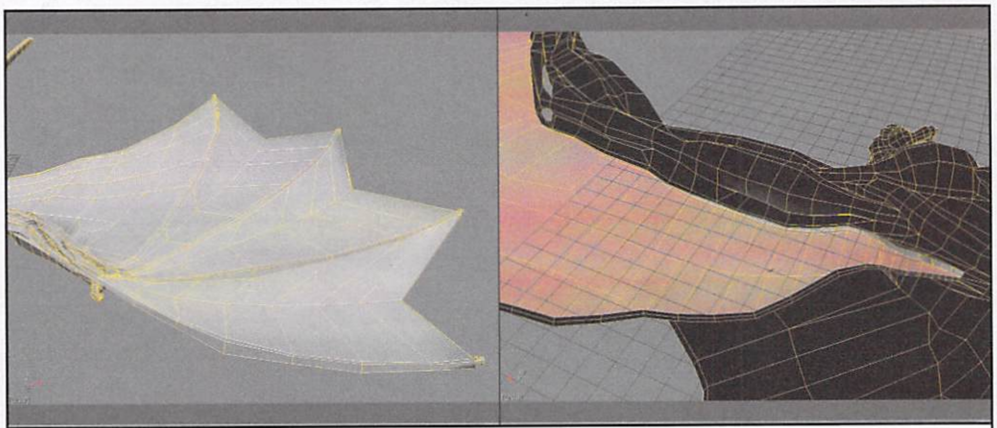


FIGURE 33– A WING CLUSTER IS CREATED AND HIDDEN. THE SURFACE IS INVERTED FOR EASY SELECTION

overlapped. We'll move the second toe over so it has its own texture space *(Figure 32)*. SOFTIMAGE |XSI is a very edit-friendly application. If we need to alter the toes by adding extra edge loops and moving points around, the UV map will be fine.

Now we'll separate the wing surfaces. The very first planar projection we applied will work well for most of the wing surfaces and the back of the dragon. It's going to be tricky to get just the right selection on all these overlapping planes, so we'll create clusters that we can edit if needed. Let's select the top surface first and create a cluster. We'll press Enter as soon as the cluster is created to open its property page and rename it to top main wing. Next, press the "h" key to hide the cluster to get it out of the way. This makes selecting the other side much easier. To get into areas that are hard to reach, we'll temporarily invert the mesh *(Figure 33)*. We'll go through this process for all the surfaces. Hiding the surface clusters reveals any missed polygons. Just select these – (Ctrl – select) the appropriate cluster, click the "+" in the edit panel and hide the cluster again. Once we're done with this, we can use the clusters to select our regions in the TE *(Figure 34 Next page)*. Selecting a cluster isolates its region in the TE. We'll select each cluster and move its region to a new location. Then, we'll select the mesh and arrange the result by mirroring the bottom halves, rotating, and translating where needed.

Next, we'll use cylindrical mapping on the tail, duplicate the process we used on the leg to the arms, and we're ready for the final stages. Inevitably, there will be stray polygons and small regions that get left behind when rearranging in the TE. For stray polygons, the fastest method is to use a "Best Fit" planar projection, see where the colored tabs show up in the TE, and use "Island Heal to Picked" to heal it back into its place.

The final stage is to scale the islands to be consistent in texture coverage, mirror our UV layout, and arrange all the islands over the image in the TE like a jigsaw puzzle. We want to maximize this space as much as possible so that our texture's resolution is used to the fullest. To maintain consistent texture resolution across seams, we need to scale the islands while looking at the model in a camera viewport. There are a couple of ways to go about mirroring our UV cluster. If the character hasn't been rigged, we can simply delete the dragon's right side and symmetrize the geometry on the left half over to the right and the UV cluster will duplicate automatically. If the character has been rigged, we can use the UV mirror script. This script works on the UV cluster only and doesn't affect the geometry. A few things to remember when using this script are to freeze your geometry, freeze your UV cluster, and get rid of extra UV clusters or you can get some strange results. A third method is to use the UV copy script. This script copies a UV cluster from one object and applies it to another overlapping object. It is especially useful if the geometry of the objects are different. Both of these scripts were written by Michael Isner and can be found at the Softimage Web site at http://www.softimage.com. Once we've mirrored the UV cluster, we can select the entire right side and horizontally flip the selected samples in the TE using Ctrl (numpad) /. We need to heal islands together that span the midline of the character. When this is complete we can fit our final layout together *(Figure 35)*.

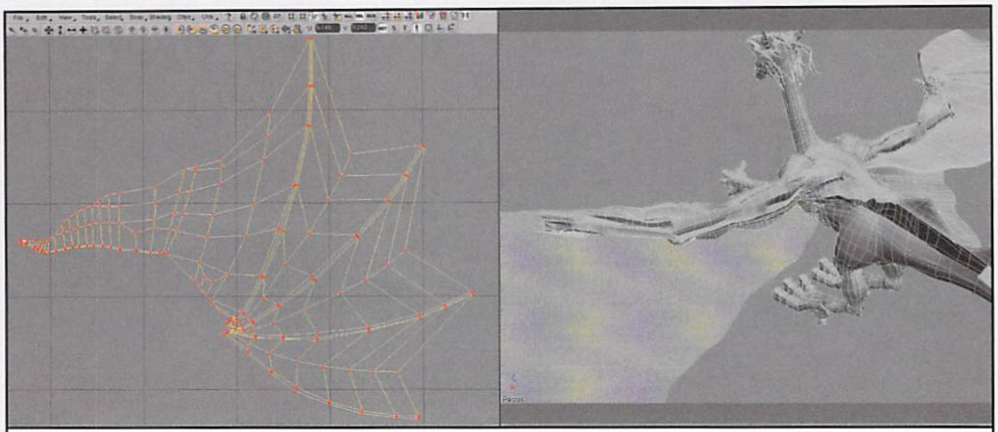


FIGURE 34– ANOTHER CLUSTER IS CREATED. SELECTED CLUSTERS ISOLATE REGIONS IN THE TE

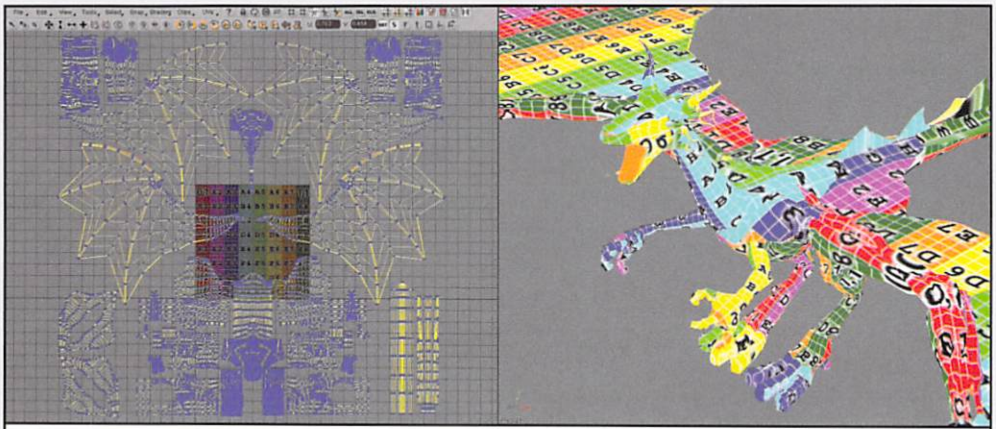


FIGURE 35– THE REGIONS ARE LAID OUT TO MAXIMIZE TEXTURE SPACE

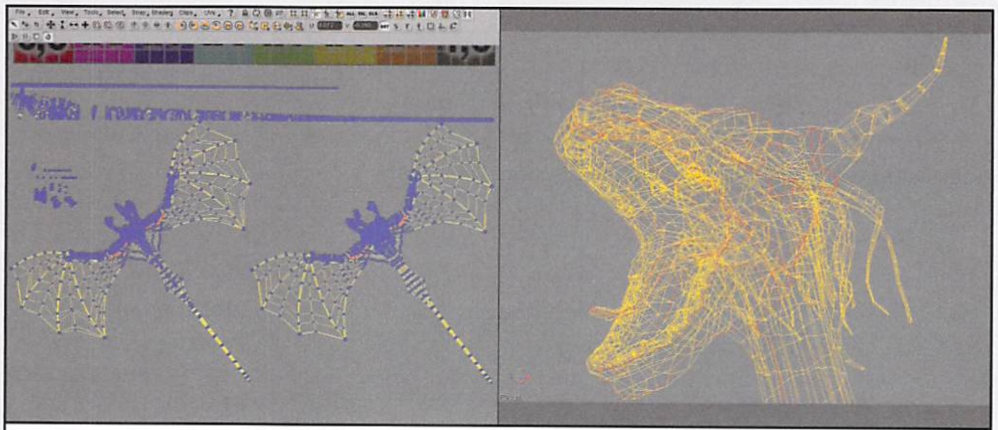


FIGURE 36– SELECT THE EDGES AND FORCE A BREAK BEFORE APPLYING THE PROJECTION

Although I didn't use a unique UV projection type in this tutorial, I want to mention it because it can save a lot of time under the right conditions. When assigning the initial texture projection to an object, unique UVs is one of the types available. This projection can break up the polygons of the object using an angle grouping option to form sample islands automatically. This works well for smooth surfaces, but requires a lot of clean up for regions with sharp angle changes and detail work. A good way to approach unique UVs is to select edges on the model and disconnect the geometry where you want to force a break before applying the projection *(Figure 36)*. As you can see, the dragon would require a ton of clean up and much more time spent selecting the edges to get better boundaries.

Lastly, objects can have more than one UV cluster applied to them. This can be useful in mapping because you can create a separate unique UV projection and copy over the regions that work.

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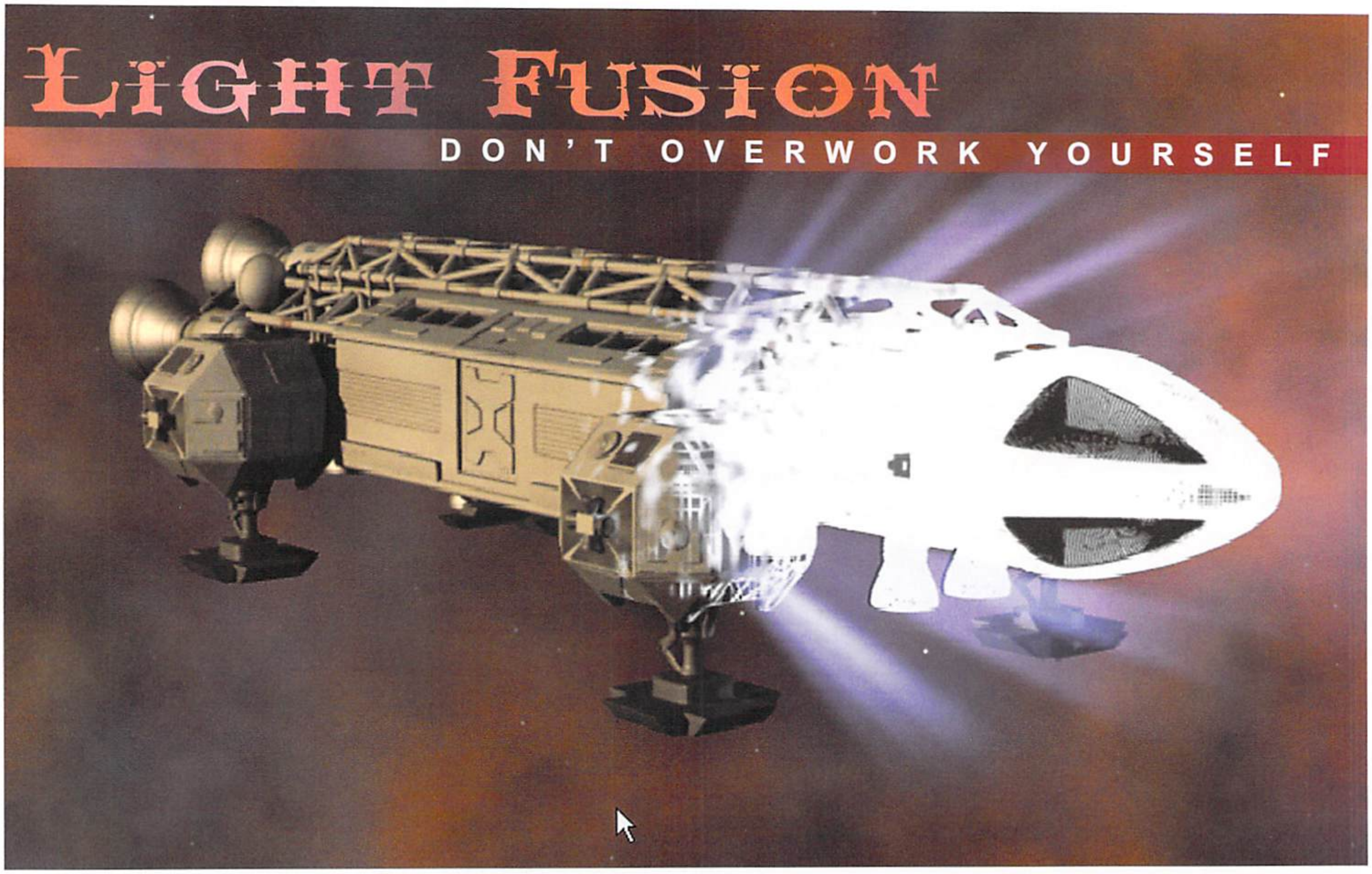
BY DEUCE BENNETT

# LIGHT FUSION

## DON'T OVERWORK YOURSELF



Hello and welcome back. I want to discuss a workflow that I use, why I consider it to be very worthwhile especially for those on a deadline, and why I feel that as 3D artists, we all need to have compositing software in our tool box. My compositing software is Digital Fusion, but the ideas and techniques should be common to all compositing software with a little modification for tools and uses.

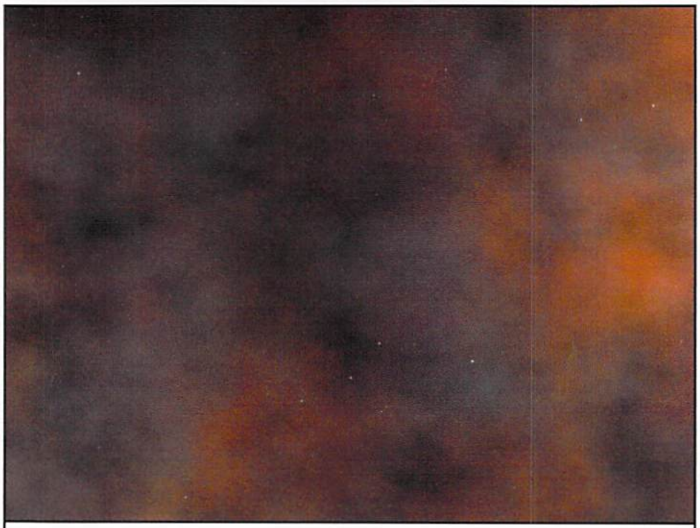
*Let's get started shall we?*

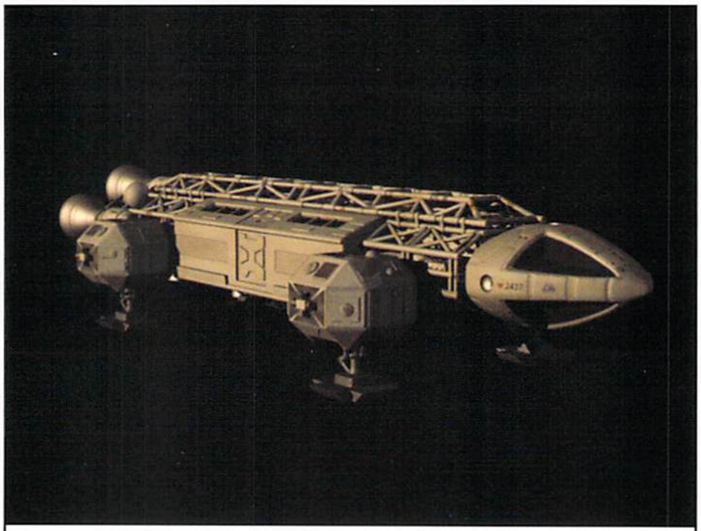
One common thing that most artists do at some point is try to do too much inside LightWave directly. This can result in a few side effects – side effects like your rendering speed will suffer, flexibility will be removed, and just overall, a loss of control. For example, I will admit that early on I did a spaceship flying over a nebula heading toward a planet in a star sphere. Don't laugh – back then that was *the* thing to do. But here's what happened. On my blazingly fast Amiga, these frames were taking 45min to render. I had over 600 frames and only one computer – this was going to take a while! But I did an experiment. I rendered the background – the nebula, the stars, the planets – these elements together rendered in about 15min a frame. Then the spaceship alone (rendering with an alpha channel) took 5min a frame. I did the compositing in LightWave itself with the background sequence in the background, and my foreground with the alpha of the spaceship and that rendered in seconds a frame. Had my whole animation rendered in half the time! I was sold.

I knew at that point that I needed a compositing application. Why? I was able to do the comp in LightWave, why get a second application? Let me explain something.

In a toolbox owned by a mechanic, you'll see socket wrenches, open end/box end wrenches, and probably a crescent wrench. What do all these tools do? They loosen nuts on bolts. That's it. But you might ask: if they all do the same thing, why do you have all of them? Why not keep one, and get rid of the others? It's because they might all do the same thing, but some do it better *in certain situations* than the others. LightWave can composite – we all know this from the example scenes that ship with LightWave; you can load in a picture of your house and put a flying saucer over it or park a super sports car in your driveway. Those are all examples of compositing. Notepad can write letters, but I wouldn't want to write a novel in Notepad. It doesn't have the tools, the formatting, and the spellchecking that a full word processor program will give me. Full compositing software will have tools that you might have never thought about needing. Flexibility galore!

Now, let's do some exploring of what control you will see. One thing that I wanted to do with this 'tutorial/discussion' is not what I see when you normally talk about LightWave and Digital Fusion. I very rarely render a specularity pass, diffuse pass, shadow pass, etc. Only time that I really do that is for a still, or print work. Animation I do in what I refer to as "element" passes.


BACKGROUND


EAGLE

What I'm going to draw from is a recent project that I did for a client that involved some creative dissolve wipes that he wanted to be three-dimensional. To work this fully in LightWave is possible, but I did it in post because of the control that it allows me.

*OK – let's get started!*

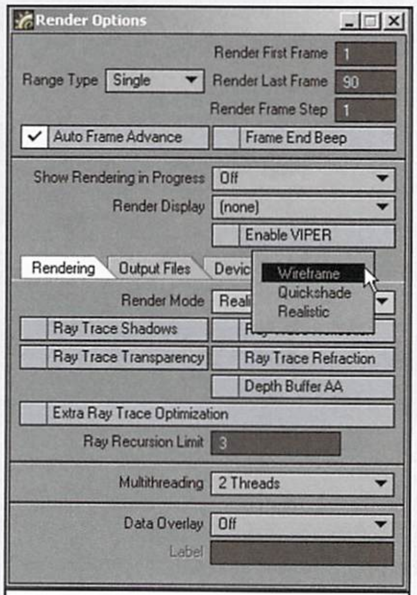
First, I'm going to make a few assumptions. This is not a beginner tutorial on LightWave or Digital Fusion. So I expect you to be able to easily follow along simply by screenshots. Adding tools, adding masks, etc. is covered in the Digital Fusion manual.

Let us set up a couple of things to get our elements for our compositing exercise. We're going to do a spaceship, specifically the Eagle from Space 1999, dissolving into a wireframe.

What we need first is a background. You can pretty much choose any background you want, or create one of your own. The specific point here is that it's *only* the background. If this were a traveling animation, you would only render the animation of your background with nothing else. I created mine with a procedural texture on the inside of a sphere to make a nebula over a starfield. The tutorial for this is fairly well known, and can be found on the Internet.

Now, we render our Eagle – and save this as a 32bit Image – I use TGA. One point of note: when you render your elements, make sure you render on a pure 0,0,0 black background. I have seen strange things when you don't – and it always does nice and happy with a pure black background.

For the sake of simplicity, I changed my render from "Realistic" to "Wireframe" and re-rendered the Eagle. I saved this as a 32bit Targa as well.



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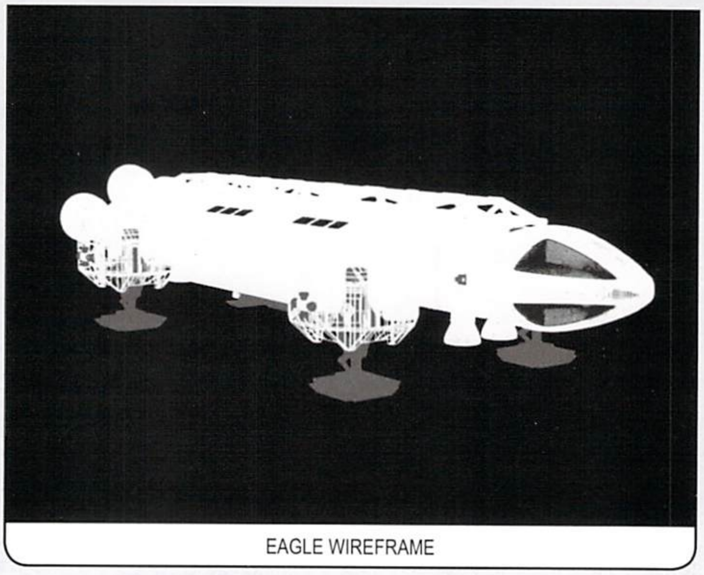
Range Type Single
Render Last Frame 90
Render Frame Step 1
☑ Auto Frame Advance
☐ Frame End Beep
Show Rendering in Progress Off
Render Display (none)
☐ Enable VIPER
Render Mode Reali
☐ Ray Trace Shadows
☐ R
☐ Ray Trace Transparency
☐ Ray Trace Refraction
☐ Depth Buffer AA
☐ Extra Ray Trace Optimization
Ray Recursion Limit 3
Multithreading 2 Threads
Data Overlay Off
Label

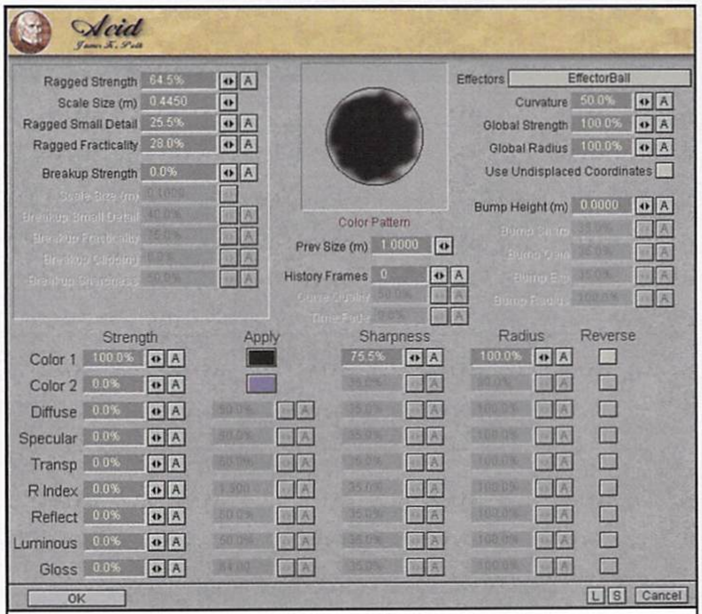
SCREENSHOT OF REALISTIC/WIREFRAME


EAGLE WIREFRAME

*Now for the creative part.*

For the dissolve, I was not interested in a simple wipe, I wanted it to have character. I used Worley's ACID plug-in to create the wipe that I wanted. I have always found it easier to work with ACID by using a sphere that has a 1-meter radius as an effector. I can see what I'm doing easier.

Now, what I have done is make the Ambient Light 100%, turned off Shadows, and made the Eagle pure white, with an ACID setting of pure black. I worked a little setting up an interesting broken edge for ACID, and thus my wipe.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Ragged Small Detail 25.5%
Ragged Fracticality 28.0%
Breakup Strength 0.0%
Effectors EffectorBall
Curvature 50.0%
Global Strength 100.0%
Global Radius 100.0%
Use Undisplaced Coordinates ☐
Bump Height (m) 0.0000
Prev Size (m) 1.0000
History Frames 0

| | Strength | Sharpness | Radius | Reverse |
|---|---|---|---|---|
| Color 1 | 100.0% | 75.5% | 100.0% | ☐ |
| Color 2 | 0.0% | | | ☐ |
| Diffuse | 0.0% | | | ☐ |
| Specular | 0.0% | | | ☐ |
| Transp | 0.0% | | | ☐ |
| R Index | 0.0% | | | ☐ |
| Reflect | 0.0% | | | ☐ |
| Luminous | 0.0% | | | ☐ |
| Gloss | 0.0% | | | ☐ |

ACID PANEL SCREENSHOT

This I animated moving over the Eagle, and saved this sequence as a 32bit Targa sequence.

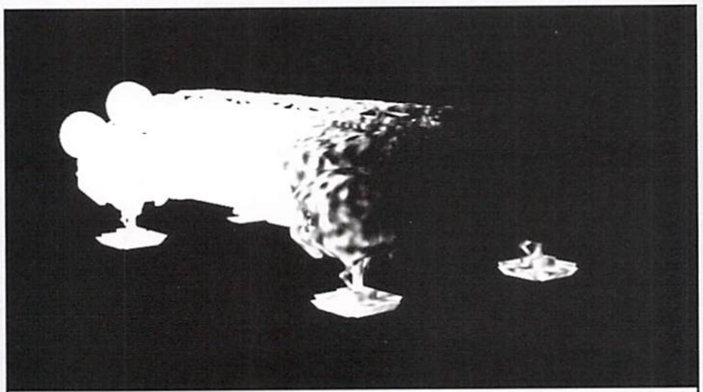
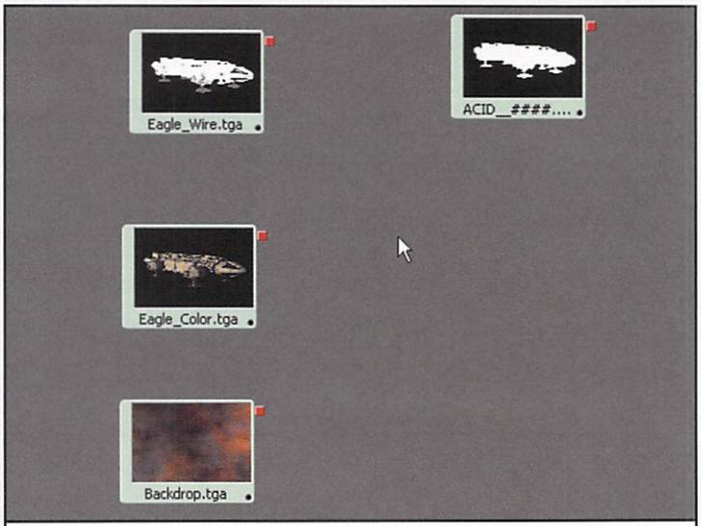


IMAGE FROM SEQUENCE

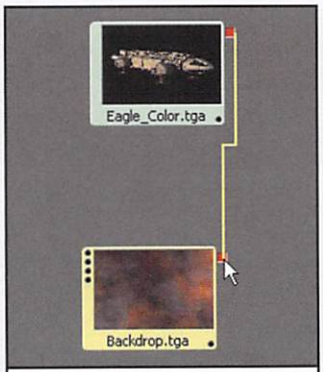
OK – we now have our elements for our transition. Now, just notice this; three stills and one animation, and the animation is basically black and white – renders very fast. The point here is that it was really easy to get the elements; now, in Fusion, we're going to have some creative fun.

Open Digital Fusion. OK – pick your method for loading in our elements. Backdrop, Color, Wireframe, and our animation with ACID.

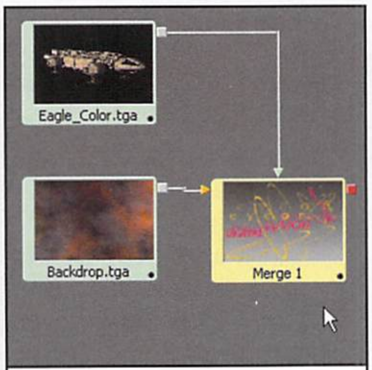


SCREENSHOT FUSION

OK, now, first things first – need our Color Eagle to be over our background – grab and drag the output of the Eagle to connect to our Background – this will set up the first stage of our comp.

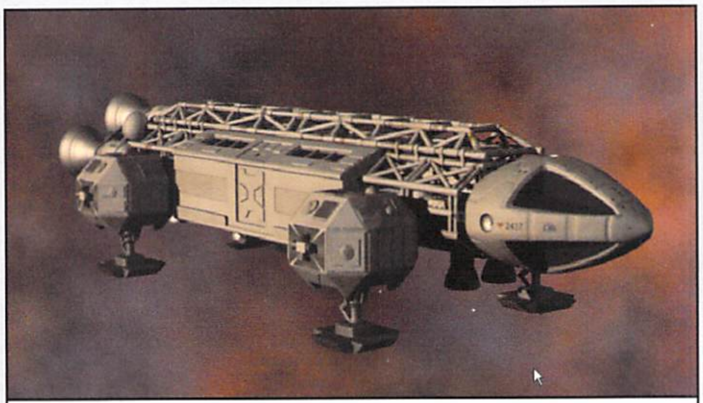


STEP 1



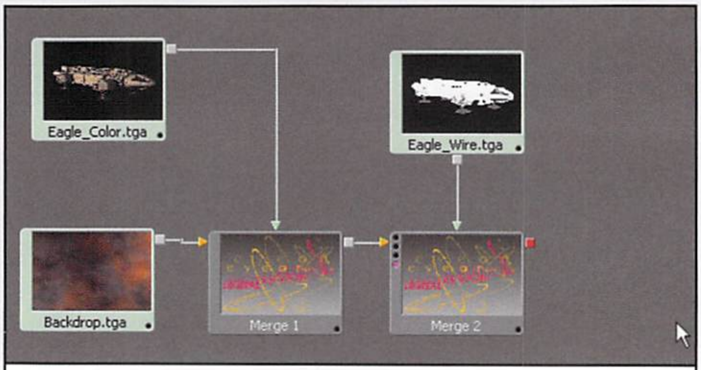
STEP 1B

Now, we can look – simple, but realize – if we wanted to change anything – we have both elements separate.

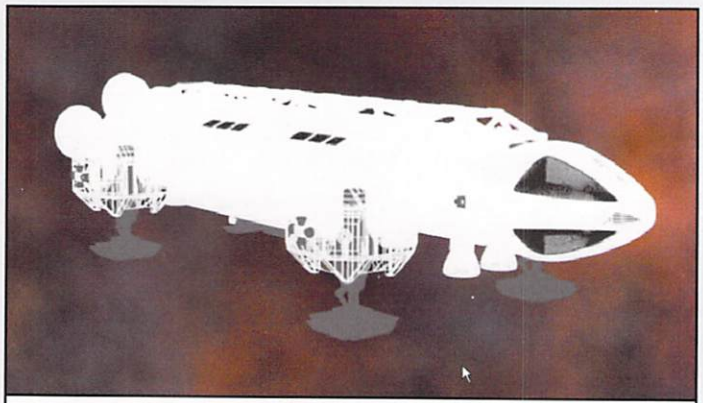


COMP

OK – now, our Wireframe goes on top of our color. Same kind of control.


Eagle_Color.tga
Eagle_Wire.tga
Backdrop.tga
Merge 1
Merge 2

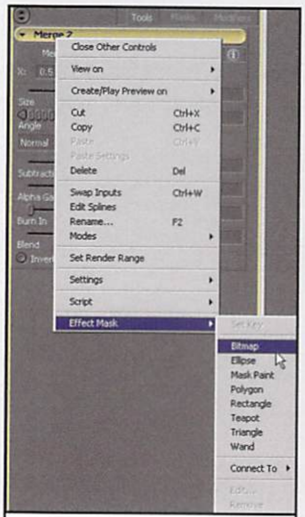
WIRE ON TOP



WIRE ON TOP – BIG

Now, here's the really neat part. We're going to use that sequence we rendered with ACID to dissolve the Ship from Color to Wireframe.

We need to add an effect mask on that last merge that we did. Right-click on the title of the merge and choose "BITMAP" under the "Effect Mask." Once that is open, drag and drop the "ACID" Loader to the "Drop Tools Here" area of the tool.


Tools
Masks
Modifiers
Merge 2
Close Other Controls
View on
Create/Play Preview on
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Paste Settings
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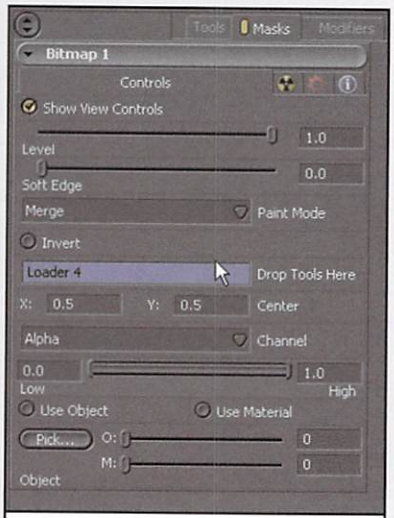
Swap Inputs Ctrl+W
Edit Splines
Rename... F2
Modes
Set Render Range
Settings
Script
Effect Mask
Bitmap
Ellipse
Mask Paint
Polygon
Rectangle
Teapot
Triangle
Wand
Connect To
Edit...
Remove

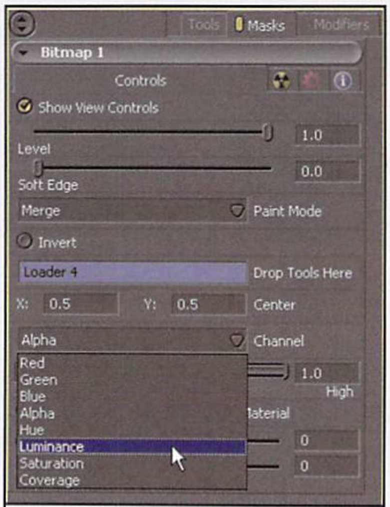
EFFECTMASK


Tools
Masks
Modifiers
Bitmap 1
Controls
Pick...

☑ Show View Controls
Level 1.0
Soft Edge 0.0
Paint Mode Merge
○ Invert
Drop Tools Here Loader 4
Center X: 0.5 Y: 0.5
Channel Alpha
Low 0.0 High 1.0
○ Use Object ○ Use Material
O: 0
M: 0
Object

DROP TOOLS HERE

Now, if we look at our output – well, nothing has changed. Why?? OH, look at the effect mask – it's using the "ALPHA" channel of our ACID animation. Well, that never changes. We have a few options here – Luminance would work – since we did a black and white render. Let's make that choice, and see what happens.


Tools
Masks
Modifiers
Bitmap 1
Controls
Red
Green
Blue
Alpha
Hue
Luminance
Saturation
Coverage

☑ Show View Controls
Level 1.0
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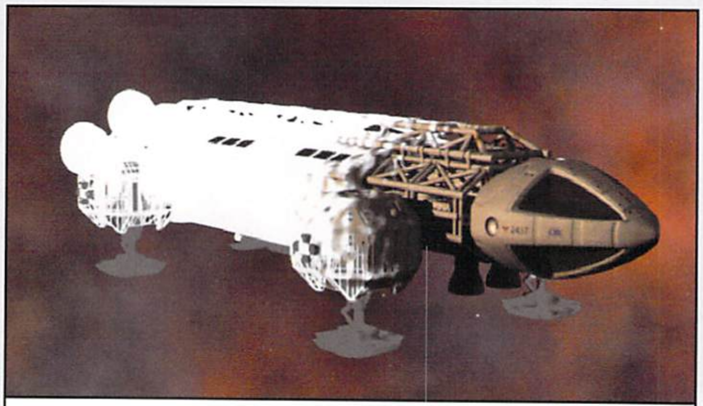
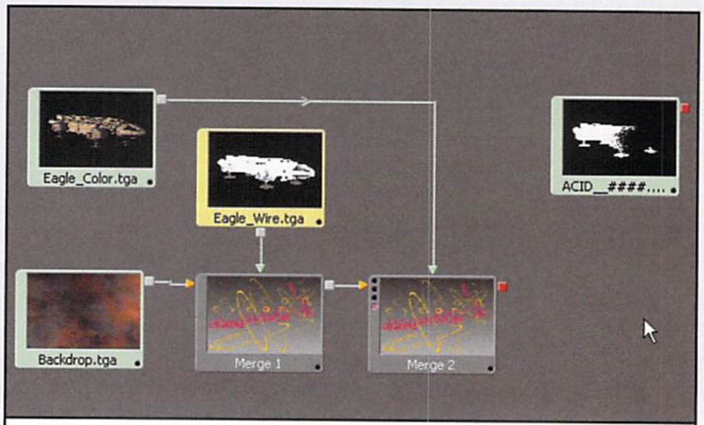
Paint Mode Merge
○ Invert
Drop Tools Here Loader 4
Center X: 0.5 Y: 0.5
Channel Alpha
High 1.0

SCREENSHOT



OUTPUT

Well, that works – but it's backwards to what we want. Well, we could reverse the Wireframe and the color – let's see.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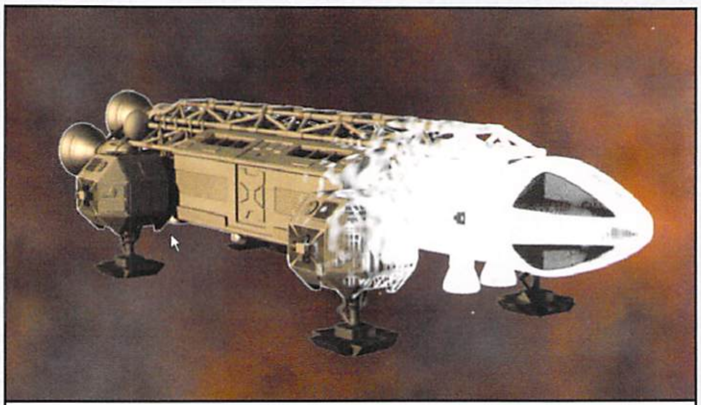
Eagle_Wire.tga
ACID_####....
Backdrop.tga
Merge 1
Merge 2

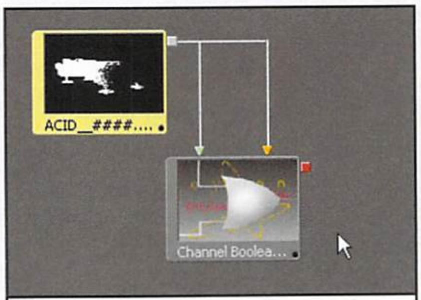
FUSION INTERFACE



OUTPUT

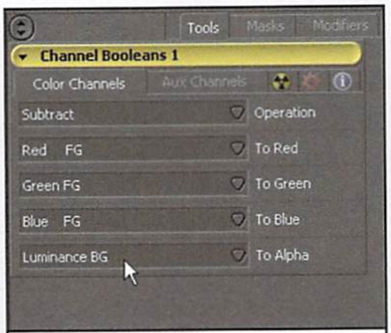
Well, that's the right direction – but do you see the "white outline" around our comp? Well, that's because the aliasing of the Wireframe made it just a slight bit larger. SO the first way was cleaner, but we need a better wipe. Not to fear, that's why you're reading this article. You want to pick up useful tips, right?

OK – put the flow back the way it was – but we're going to use a very cool tool in Fusion. It's called Channel Booleans. We're going to use this to make an Alpha channel, instead of Luminance to do our wipe. It will also give us more control over any other effects that we want to follow the change.



HOOKUP

Hook up the Channel Booleans to the ACID for both foreground and background.

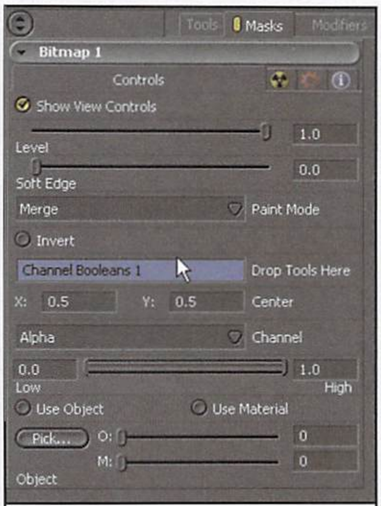


Subtract – Operation
Red FG – To Red
Green FG – To Green
Blue FG – To Blue
Luminance BG – To Alpha

CONTROLS

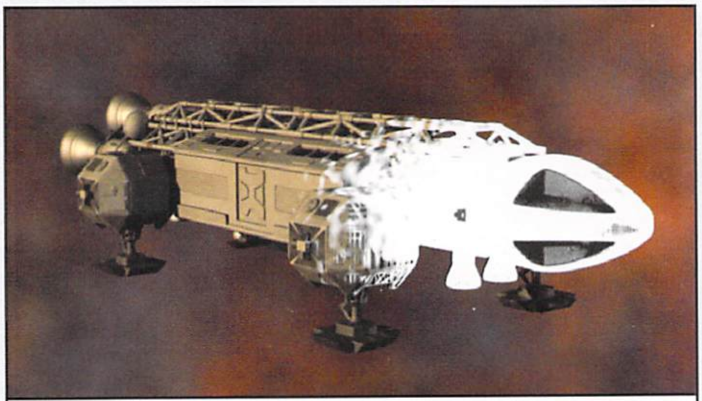
Now, look at the controls. What we want to do is to "Subtract" the Luminance from the Alpha channel to make a new alpha channel.

Now, if we drag the Channel Booleans into the "Drop Tools Here" part of the effect mask...



☑ Show View Controls
Level: 1.0
Soft Edge: 0.0
Paint Mode: Merge
○ Invert
Drop Tools Here: Channel Booleans 1
Center: X: 0.5 Y: 0.5
Channel: Alpha
Low: 0.0 High: 1.0
○ Use Object ○ Use Material
Object: O: 0 M: 0

SCREENSHOT

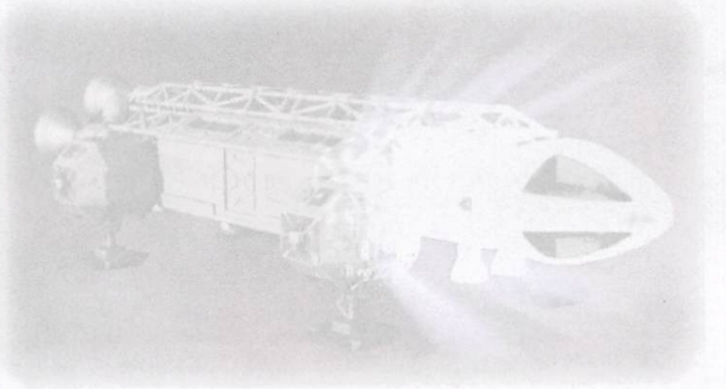


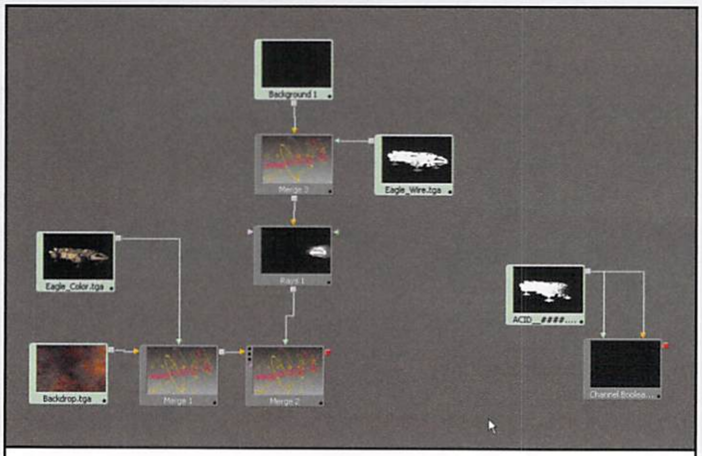
RESULT

Now, that's what we wanted.

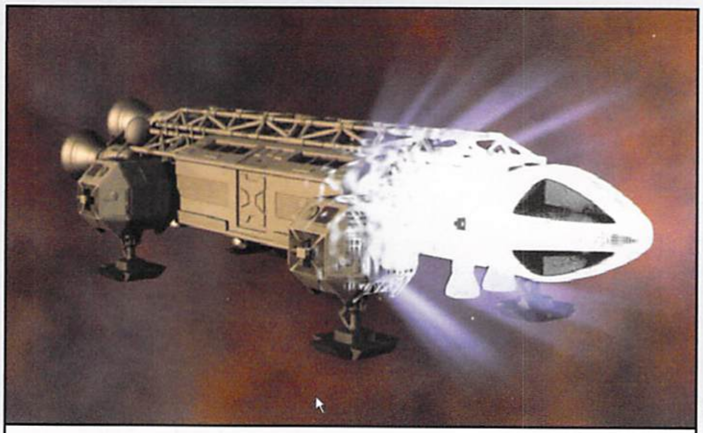
OK – I was talking about 'flexibility' during this article. With a little understanding of how layering works, and where to put the effect mask of our alpha, you can easily create other effects on top of the basic dissolve.

By putting the Wireframe over a separate background of its own, with a transparent alpha – it's easy to use a "rays" effect in addition to the dissolve.





OPTION ONE



OUTPUT

I hope that this gives you an idea of what is possible when you use a compositing application with LightWave or your 3D application of choice. The flexibility, the ease of rendering, and the ability of 'creating after the fact' are all valid reasons for looking at a compositing application, and you can get all this without having to worry about doing a specular pass, diffuse pass, etc. – just the layering of elements is enough.

**JACK "DEUCE" BENNETT II** IS A FREELANCE CGI ARTIST WITH A BACKGROUND IN PHYSICAL SPECIAL EFFECTS FOR MOTION PICTURES AND TELEVISION. DEUCE HAS BEEN WORKING IN THE FILM INDUSTRY HIS ENTIRE LIFE, AND HAS SUCH MOVIES AS *ROBOCOP, LONESOME DOVE, AND JIMMY NEUTRON: BOY GENIUS* TO HIS CREDIT, AS WELL AS TV SHOWS LIKE *WALKER, TEXAS RANGER.* DEUCE HAS BEEN USING COMPUTERS SINCE HE WAS 9, AND STARTED OFF WRITING HIS OWN GRAPHIC PROGRAMS. HE IS A UNIQUE COMBINATION OF PHYSICAL KNOWLEDGE AND VIRTUAL KNOW-HOW.

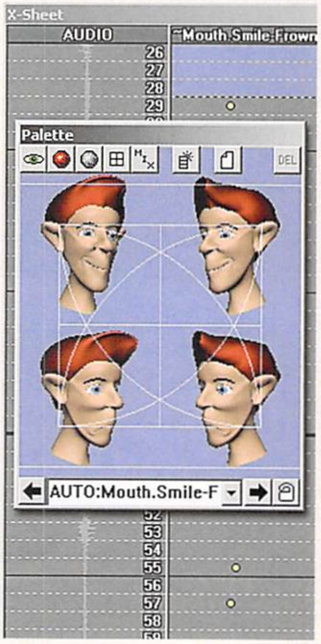
# RE-WRITING THE RULES – FACIAL ANIMATION

BY TIM ALBEE

The phrase, "nothing is perfect," seems to go double for 3D applications. We all slog through dealing with programmatic quirks from the "minor inconvenience" to the "supremely frustrating." We're artists after all, not programmers, and we're better off not moaning about things we can't change, and just do our jobs, right?

Wrong! Rather than "suck-up and drive-on," I made a wish list and got together with a programmer to make some 3D animation tasks easier, simpler, more elegant.

See the full story behind the ensuing partnership and solutions www.hdri3d.com/xtra/albee.



# *Touch* and GO!

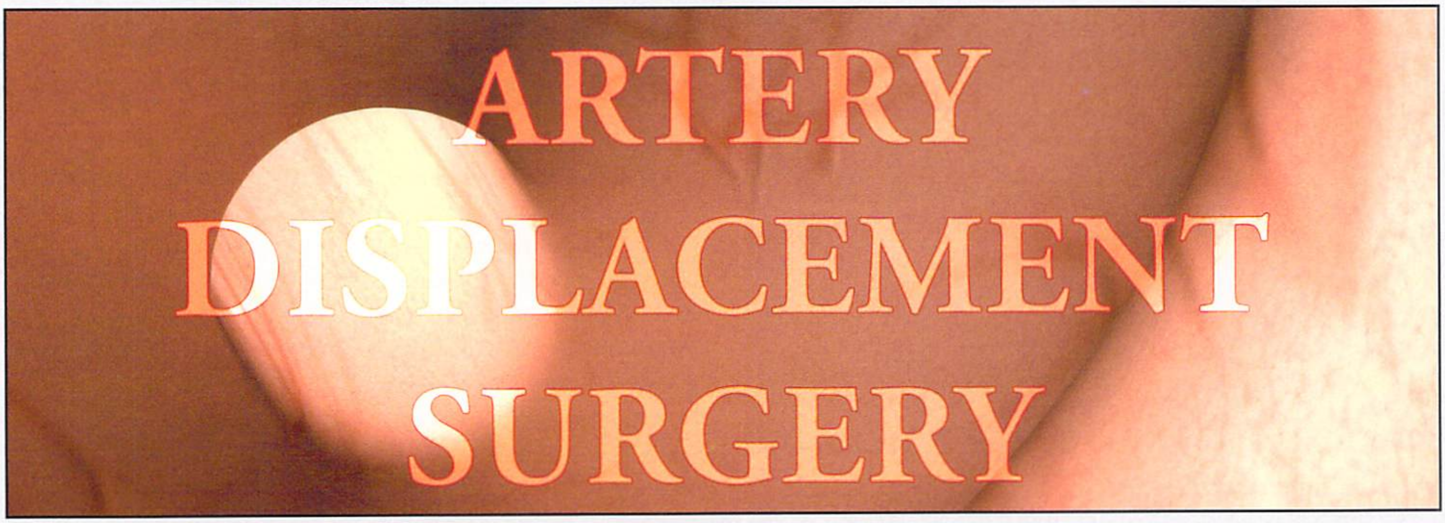
REVIEW BY CHARLES EDGIN

We're always on the lookout for fast and affordable data storage. When we saw that Maxtor was releasing a new and improved 250GB OneTouch drive, we couldn't wait to check it out.

Portable and USB2/Firewire ready. Backups are as easy as pressing a button on your way out to lunch. But just how new and improved is it?

You'll find our complete review of the Maxtor OneTouch™ II at www.hdri3d.com/xtra/onetouch.

BY AARON KENT



# ARTERY DISPLACEMENT SURGERY

Luckily, there's usually more than one way to skin a cat. Most 3D artists usually have one aspect of their software that they're better at than others. Your modeling is great and your texturing isn't bad, but you really have to work on your animation skills. Or maybe your animation is really solid, but you light the scene terribly. I've found that it's good to rely on applications other than your 3D program to get the job done.

Let's face it: Nothing comes out of a 3D render engine in final form. There's always some compositing or adjustment in a paint program. Other programs can play a role in all sections of the production pipeline. If you're strong in another application besides your 3D program, why not use that to your advantage? That said, what follows is a simple tutorial where we'll create some displacement maps in Adobe After Effects, rather than LightWave's displacement Texture Editor.

What? LightWave's texture engine is great ... it whips up oceans, wormholes in spacetime, human skin, and a million other things really well. This is all true, but sometimes you'll find that you can achieve some fairly intricate animations with displacement maps animated in After Effects. Also, the layering options in the LightWave Texture Editor are robust enough to allow you to use a little of both, if need be.

We'll break this tutorial into several parts. First, we'll make a human artery in Modeler and create a texture map for it inside Photoshop. Then, using that texture map as reference, we'll animate a displacement and bump map for the texture in After Effects. Why an artery? It seemed like a good idea, and medical modeling and visualization seems to be a field where you can rustle yourself up some work if you're pretty good at it.

## MODELING THE ARTERY

The artery is just a simple cylinder that we'll bend in Layout with a couple bones. Figure 1 (see figure 1) shows the tube in Modeler. You have to make the mesh thick enough that it will displace well, but don't make it too polygon heavy or you'll never get your job done. I've settled for 20 sides and sixty segments. Don't forget to delete the polygons at each end of the tube and subpatch the object, then send it into Layout. Draw a couple of bones and bend the tube a bit and you've got an artery (see figure 2). Note: we're not creating any earth-shatteringly

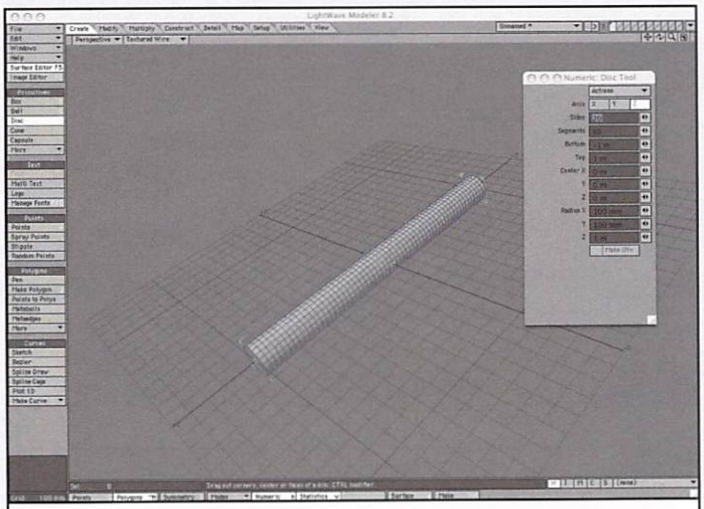


FIGURE 1– A SIMPLE TUBE IS CREATED USING THE DISC TOOL

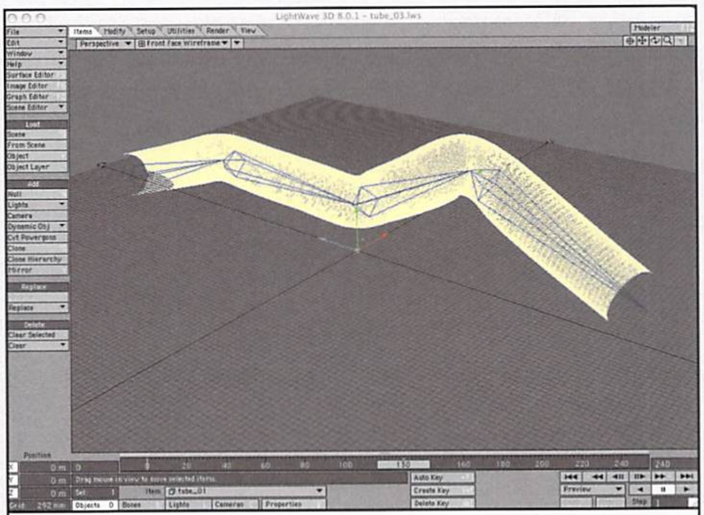


FIGURE 2– ADD THEM BONES AND BEND THE TUBE OBJECT

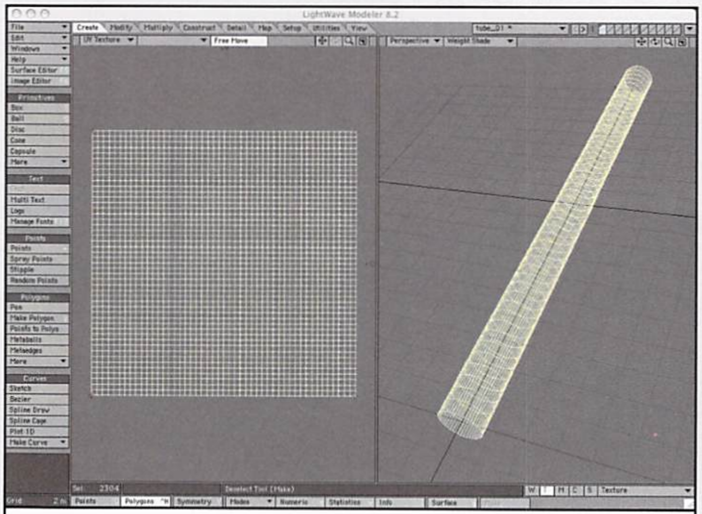


FIGURE 3– THE TUBE AND ITS UV MAP

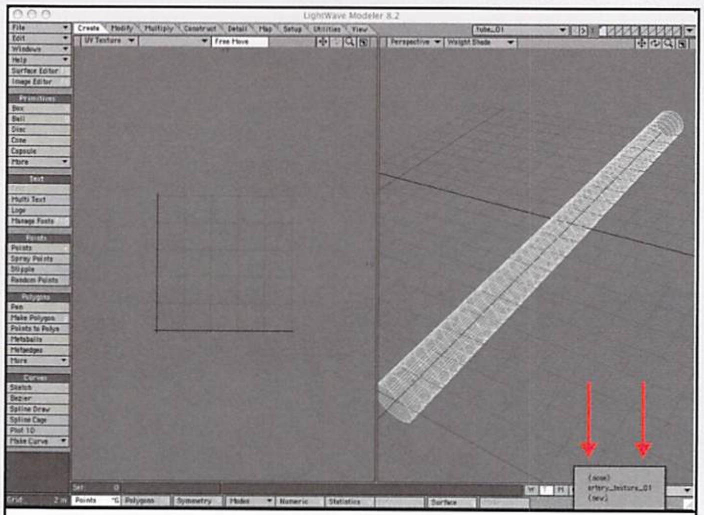
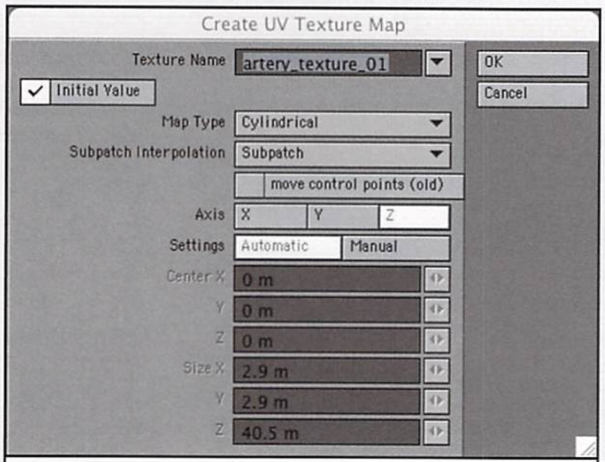


FIGURE 4– BY SELECTING "(NEW)" INSIDE THE TEXTURE MAP SELECTOR, YOU CAN CREATE A NEW UV MAP FOR ANY SELECTED POLYGONS OF AN OBJECT. IN THE IMAGE YOU'LL SEE I'VE ALREADY CREATED A UV MAP CALLED "ARTERY_TEXTURE_01"



Create UV Texture Map

Texture Name: artery_texture_01

☑ Initial Value

Map Type: Cylindrical

Subpatch Interpolation: Subpatch

move control points (old)

Axis: X Y Z

Settings: Automatic Manual

Center X: 0 m

Y: 0 m

Z: 0 m

Size X: 2.9 m

Y: 2.9 m

Z: 40.5 m

OK

Cancel

FIGURE 5– THE UV TEXTURE MAP DIALOGUE BOX PROVIDES A NUMBER OF OPTIONS WHEN INITIALLY CREATING A UV MAP

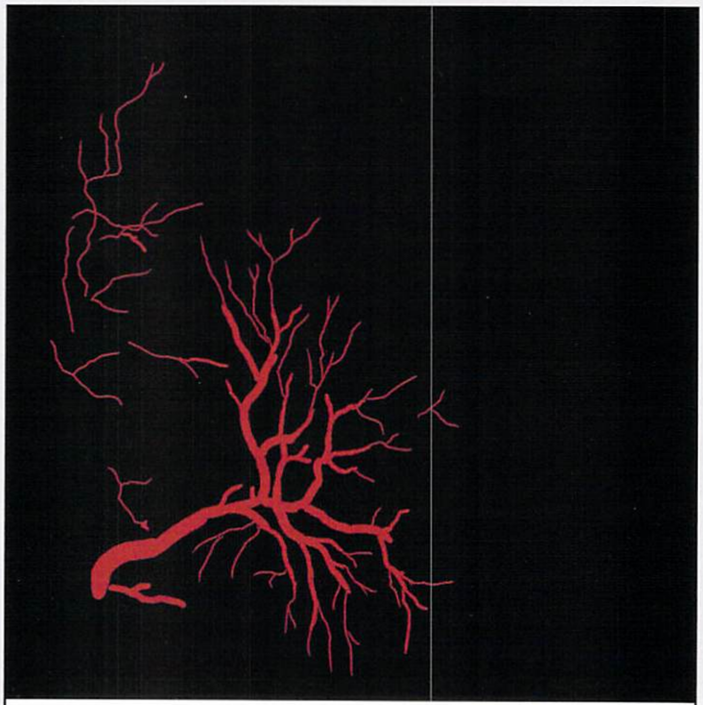


FIGURE 6– MAKE USE OF PHOTOSHOP'S BRUSH WIDTHS AND SHAPES TO VARY THE WIDTH OF THE VEINS IN YOUR TEXTURE

complex model here, or going into any bone deformation tips or tricks. We'll focus more on the displacement maps. Remember, the maps will work for any situation with some preplanning and texture/UV mapping. Bones aren't the only way to go, they just suit this subject matter and tutorial.

## TEXTURING THE ARTERY

Back in Modeler, let's create a UV map for the tube (see figure 3). Select all of the polygons in the tube then, at the lower right corner of the Modeler interface, press the letter "T" and drag the texture requester to "new" (see figure 4). In the UV dialog box that opens, name the UV map something logical, set the mapping to "Cylindrical," set the axis to "Z," and press "enter" to create the map (see figure 5). This isn't a UV mapping tutorial (and I'm still a bit of a novice at it myself), so this is pretty basic. We won't adjust the map at all. Actually, by the time we finish this process, the bit of stretching from the map is nice because it makes the textured arteries look a little more realistic on the sides of the artery wall.

Using the UV map as reference (mine happens to be 915 by 915 pixels), make a Photoshop file of the same size. Next, head to the wonderful world of the Internet. Find yourself a reference of arteries, drag them into a layer in your Photoshop document, and start painting your own arteries in another layer. Paint the arteries dark red and vary the weight of your brush as you go (see figure 6). Once you get a web of arteries that you're happy with, duplicate it and spread it out over the entire image. Duplicate that layer, and add a Gaussian Blur to soften the edges. Add a Gaussian Blur to the first layer as well, not as powerful as the duplicate, but enough to soften any hard paint strokes. Make a background layer, and make it a lighter version of that red (see figure 7). That should do it for the artery layer; we'll add the rest of the detail inside LightWave. Now, on to the animated displacement maps.

## ANIMATING THE DISPLACEMENT MAPS

For this tutorial, I'm using After Effects 6.0 Professional without any third party plug-ins, but the concepts should apply to whatever animated paint/compositing software you use (however inferior). Start off by creating a new comp. Make its dimensions 915 by 915 pixels. We need a turbulent noise background to make the artery undulate constantly, but not drastically. Make a solid layer *(Layer > New > Solid).* In the New Layer dialogue box that opens, make sure to hit the "Make Comp Size" button so that the solid is 915 by 915 pixels. Apply the Fractal Noise plug-in to that layer *(Effect > Noise > Fractal Noise).* The Fractal Noise plug-in is the equivalent of LightWave's Procedural Texture Generator. If you're familiar with either, then getting used to the other won't take long.

Design is refinement, in my opinion. I'm showing you some settings in this tutorial, but in the end it's up to you. You'll learn the Fractal Noise plug-in or the LightWave Procedural Generator by playing around with them. Skip that TV rerun that you've seen eight times already, and put in some time with the program. Or, just dial up some settings in either application and see what the plug-ins can do. Then, let it render while you watch *Knight Rider* episode 24 for the ninth time.

Leave the default settings on inside the Fractal Noise plug-in and animate the Evolutions setting to create a slow undulating procedural texture. My entire LightWave animation will be eight seconds (or whatever the doctor orders). Figure 8 shows the composition with just the turbulent noise layer applied. Since we're going to cylindrically wrap this texture, we don't want to see a seam. As it stands, the edges aren't going to match up. So, we'll use another After Effects plug-in to fix this. With the turbulent layer still selected, apply the Offset plug-in *(Effect > Distort > Offset).* It works the same as its Photoshop counterpart. It horizontally or vertically shifts the edges of a selected image. This way, the sides will now match when this texture is wrapped end to end.

But what about those nasty seams running down the center (see figure 9)? To fix those, make a duplicate of the turbulent noise layer and remove the offset plug-in. Then, create a mask so that it just covers the seams of the image below it. Feather the mask and those nasty seams are gone (see figure 10). The very edges of the masked turbulent noise layer won't wrap perfectly, but if you mask the layer and feather it carefully enough, the result is almost imperceptible. If you do notice a little pixel aberration at the edge, you can always apply a soft blur in LightWave's Image Editor. Also, remember, it's a displacement map, so as long as the seams aren't painfully obvious, you'll be OK.

Finally, let's add a solid black layer over the top of the turbulent noise layers. This is an easy way to quickly lower the Luminance values of the turbulent layers. To avoid having the artery shake uncontrollably between heartbeats, set the solid layer at an Opacity of 70% to darken

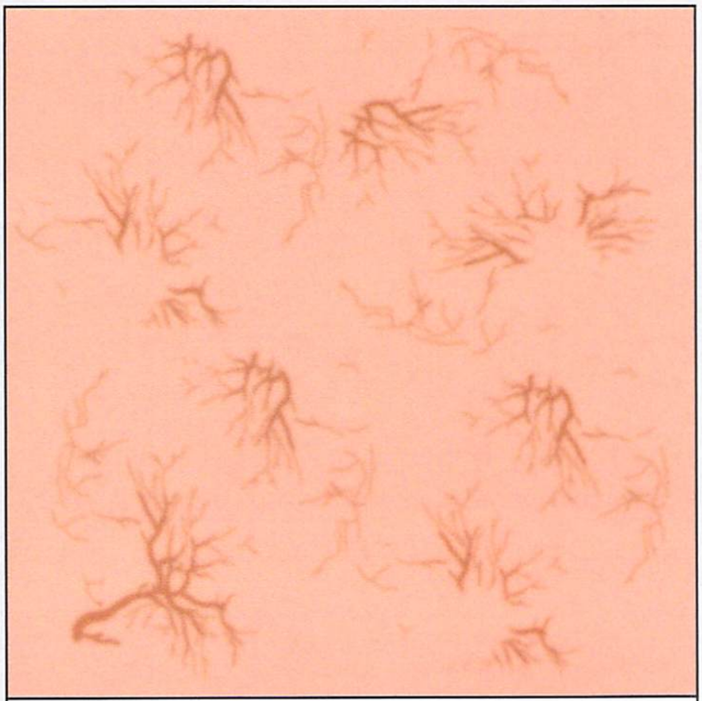


FIGURE 7– THE VEINS HAVE BEEN DUPLICATED AND SPREAD ACROSS THE TEXTURE. MASKING OFF DIFFERENT SECTIONS OF EACH DUPLICATE KEEPS THEM FROM ALL LOOKING ALIKE

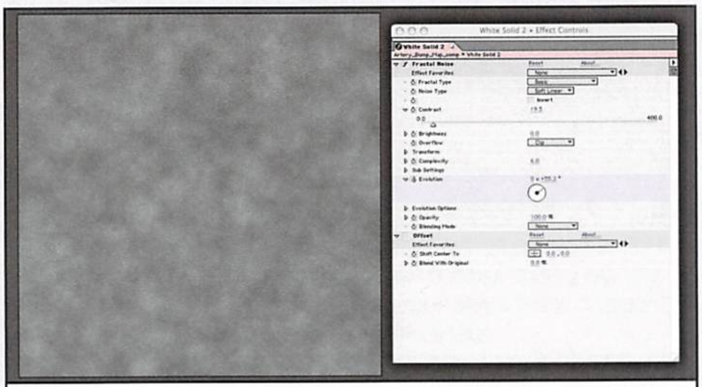

White Solid 2 • Effect Controls
White Solid 2
Artery_Bump_Map_comp • White Solid 2
Fractal Noise
Reset
About...
Effect Favorites
Fractal Type
Noise Type
Invert
Contrast
Brightness
Overflow
Transform
Complexity
Sub Settings
Evolution
Evolution Options
Opacity
Blending Mode
Offset
Shift Center To
Blend With Original

FIGURE 8– JUST A LAYER WITH THE FRACTAL NOISE PLUG-IN APPLIED

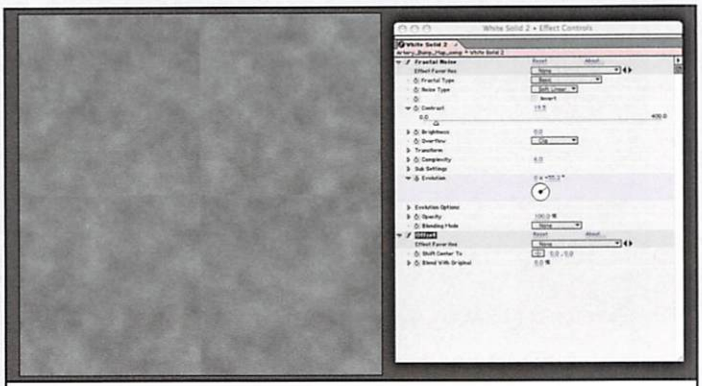

White Solid 2 • Effect Controls
White Solid 2
Artery_Bump_Map_comp • White Solid 2
Fractal Noise
Reset
About...
Effect Favorites
Fractal Type
Noise Type
Invert
Contrast
Brightness
Overflow
Transform
Complexity
Sub Settings
Evolution
Evolution Options
Opacity
Blending Mode
Offset
Shift Center To
Blend With Original

FIGURE 9– THE OFFSET PLUG-IN HAS MADE THE EDGES OF THE IMAGE MATCH, BUT WE'RE LEFT WITH SEAMS CROSSING THE CENTER OF THE IMAGE HORIZONTALLY AND VERTICALLY

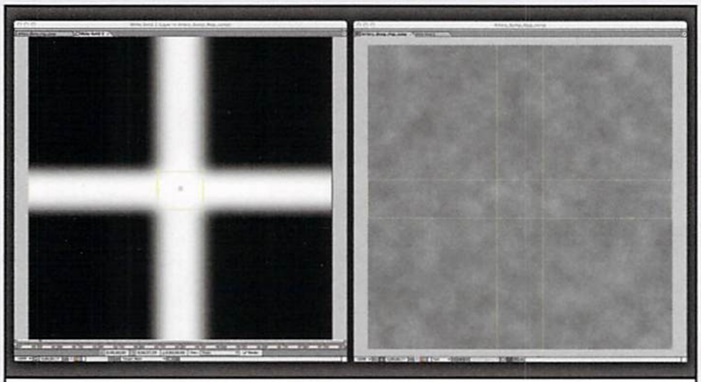


FIGURE 10– ON THE LEFT WE SEE THE MASKS WE'VE APPLIED TO THE TURBULENT LAYER WITH NO OFFSET. ON THE RIGHT WE CAN SEE THAT THE FEATHERED MASKS HIDE THE SEAMS QUITE NICELY

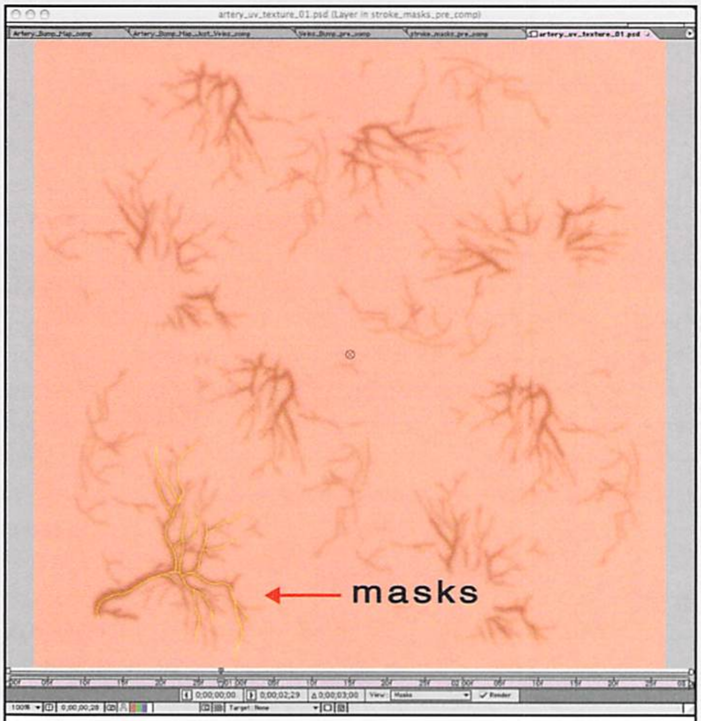


FIGURE 11– USE THE PEN TOOL IN AFTER EFFECTS TO DRAW MASKS THAT TRAVEL ALONG THE VEINS WE PAINTED IN PHOTOSHOP

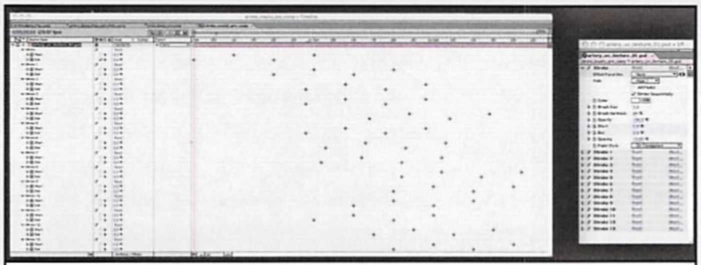


FIGURE 12– THE GRAPH EDITOR SHOWS THE ANIMATED START AND END VALUES OF EACH STROKED MASK. IN THE PLUG-IN DIALOGUE BOX ON THE RIGHT, EACH STROKE IS SET TO CONTROL A DIFFERENT PATH. NEXT TO THE "PATH" OPTION IN EACH ITERATION OF THE STROKE PLUG-IN, ANY MASKS DRAWN ON THE LAYER CAN BE SELECTED

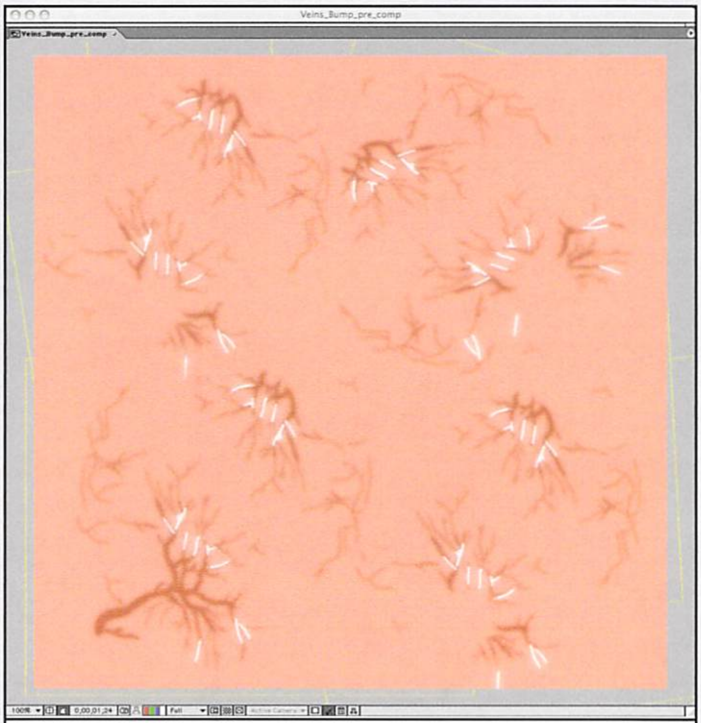


FIGURE 13– I'VE RENDERED THE STROKED VEINS ANIMATION AND DUPLICATED IT SO THAT IT COVERS EACH COPY OF THE VEINS I PAINTED IN MY TEXTURE MAP. USE A FEATHER MASK ON EACH COPY OF THE MOVIE SO THEY ALL APPEAR SLIGHTLY DIFFERENT

the turbulent layers and keep their displacement to a minimum. Now, on top of the turbulent noise layers, we're going to create an animated bump map to compliment the image of the arteries. First, drag the texture we created of the arteries into an After Effects comp of the same size. Using the Mask tool, create a number of paths that travel along the arteries (see figure 11). Once the masks are drawn, apply the Stroke plug-in *(Effects > Render > Stroke)* to the layer. Since we've drawn 13 different masks along the arteries, we'll need to apply the Stroke plug-in 13 times onto the same layer. Then, assign each iteration of the plug-in to a different masked path to control it. By animating the start and end values of each path, we can send a stroke traveling down the shape of the mask, kind of like blood coursing through an artery. It's also good to add a bit of Gaussian Blur to the entire layer and use the Simple Choker plug-in *(Effect > Matte Tools > Simple Choker)* to smooth any rough edges. As shown in figure 12, you should stagger the place each stroke's keyframes start and stop on the timeline. This ensures that it looks like the stroke is traveling in a logical manner, through the bigger tubes and then branching off into the smaller ones. The smaller arteries get a smaller brush stroke applied inside the Stroke plug-in.

Next, pre-render the animation shown in figure 12. Then, take that movie file and place it over the other arteries in the texture map. Since we've cloned the same painted arteries in the texture map, the bump movie will line up on top of everything (see figure 13). Once this comp is finished, drag it into the turbulent noise comp and set its opacity to a very small number (somewhere between 4-10%) and then apply a Gaussian Blur. I want the veins in the displacement map to distort the artery lining a little bit, but I'm more interested in rendering out a

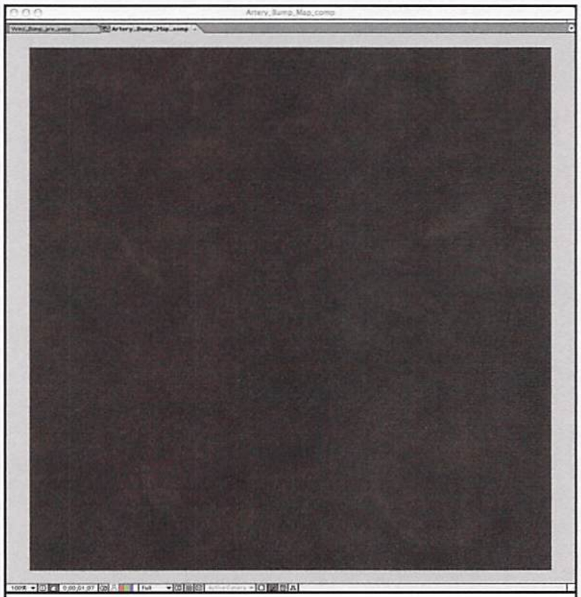


FIGURE 14– THE DISPLACEMENT MAP IS ALMOST FINISHED

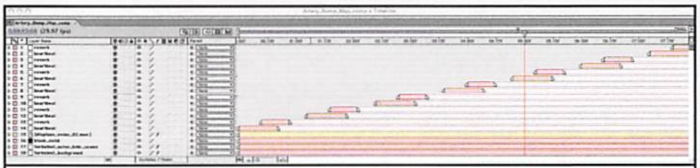


FIGURE 15– WE CAN EASILY CONTROL THE SPEED OF THE HEART BEAT BY ADJUSTING THE SPEED AND FREQUENCY OF THE MASKS TRAVELING THE WIDTH OF THE TEXTURE MAP

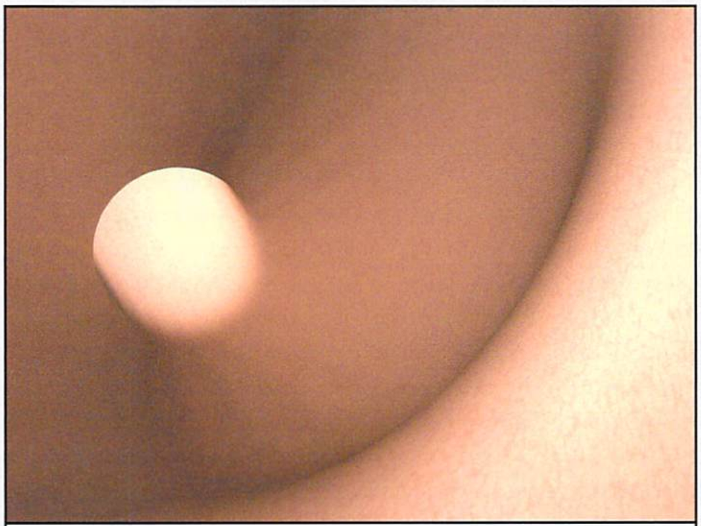
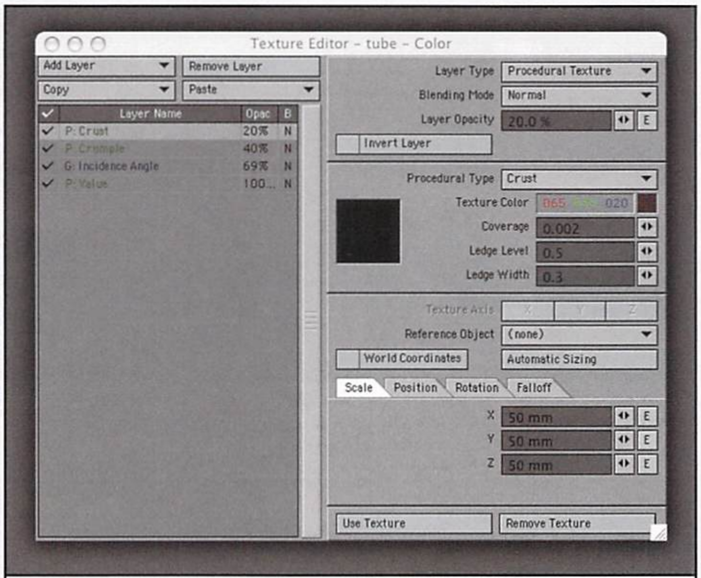


FIGURE 16– THE ARTERY WITH JUST A SKIN SURFACE SETTING APPLIED

high-contrast black and white version of the veins movie to apply to the artery's bump channel inside the LightWave Surface Editor. Figure 14 shows a screenshot of the turbulent noise and veins. It's important to note that I don't break frame with the arteries in the image. You don't want to try to offset images that are too complicated. Just make sure you spread out the arteries evenly in the texture and it will look evenly spaced when it's cylindrically wrapped.



| ✓ | Layer Name | Opac | B |
|---|---|---|---|
| ✓ | P: Crust | 20% | N |
| ✓ | P: Crumple | 40% | N |
| ✓ | G: Incidence Angle | 69% | N |
| ✓ | P: Value | 100... | N |

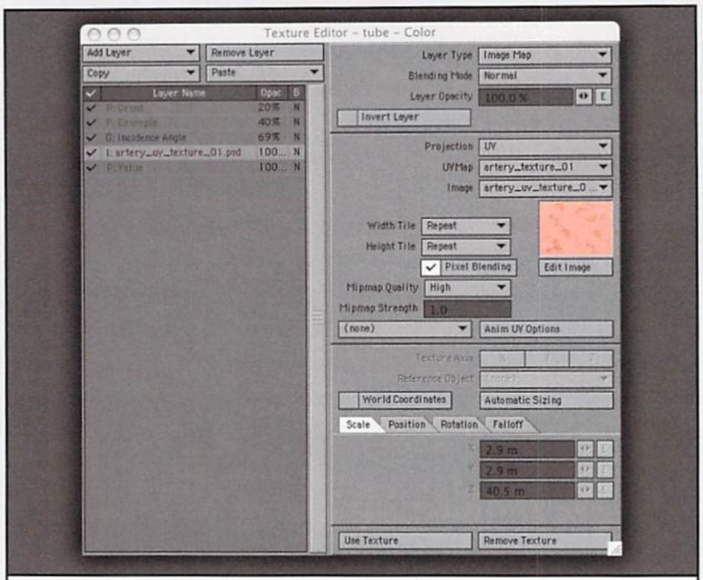
Layer Type: Procedural Texture
Blending Mode: Normal
Layer Opacity: 20.0 %
Procedural Type: Crust
Texture Color: 065 [illegible] 020
Coverage: 0.002
Ledge Level: 0.5
Ledge Width: 0.3
Reference Object: (none)
X: 50 mm
Y: 50 mm
Z: 50 mm

FIGURE 17– THE TEXTURE EDITOR FOR THE ARTERY'S SURFACE COLOR. A PRETTY COMPLICATED TEXTURE COMPRISED OF THREE PROCEDURAL LAYERS AND A GRADIENT LAYER

OK, just one more step for the displacement map: The heartbeat. It should travel the length of the artery and displace the geometry enough that we perceive some kind of pulmonary action happening. We'll use masks to accomplish this again. (You're probably starting to notice a pattern here; if you're an After Effects artist you already know how invaluable the masking tools are for just about everything. Now if Adobe can just get that cappuccino maker plug-in out of beta, the application will be perfect...) Make a white solid, then mask and feather it. Then, keyframe its position to travel the length of the comp horizontally. It will take a little rendering and experimenting to get the width and speed we want. The nice part is we don't have to apply the offset plug in to this layer because it's white, ensuring that the masked edges match up perfectly. Then, make a duplicate of the solid that travels the width of the comp a couple of keyframes later to simulate the little double beat a heart makes when it's pumping. Once you like the animation of the two layers, duplicate them and space them out according to how fast you want your patient's heart rate, and you're done (see figure 15).

## APPLYING THE ANIMATIONS INSIDE LIGHTWAVE

Let's apply the textures and displacement maps inside of LightWave Layout. By playing around with the surface setting and an image map, we can quickly cook up a pretty cool internal tissue texture. Start with one of the human skin settings that ship with LightWave [8] (only available with LW [8] and up) and tweak it a bit. Figure 16 (see figure 16) shows the artery with surface settings applied, but without texture, bump, or displacement maps applied. First, we'll apply the surface texture. In the Surface Editor, open the options for color and add the texture. The skin texture preset that we initially applied to the artery is a fairly complicated preset. There are already four different layers inside the Color Texture Editor (see figure 17). We'll add the skin texture as the second layer in the layer order (as shown in figure 18).


Texture Editor - tube - Color
Add Layer
Remove Layer
Copy
Paste
Layer Name
Opac
B
Invert Layer
Edit Image
Anim UV Options
Texture Axis
Reference Object
World Coordinates
Automatic Sizing
Scale
Position
Rotation
Falloff
Use Texture
Remove Texture

P: Crust 20% N
P: Crumple 40% N
G: Incidence Angle 69% N
I: artery_uv_texture_01.psd 100... N
P: Value 100... N

Layer Type: Image Map
Blending Mode: Normal
Layer Opacity: 100.0 %
Projection: UV
UVMap: artery_texture_01
Image: artery_uv_texture_0 ...
Width Tile: Repeat
Height Tile: Repeat
☑ Pixel Blending
Mipmap Quality: High
Mipmap Strength: 1.0
(none)
X: 2.9 m
Y: 2.9 m
Z: 40.5 m

FIGURE 18– HERE WE'VE ADDED OUR TEXTURE MAP TOWARDS THE BOTTOM OF THE STACKING ORDER

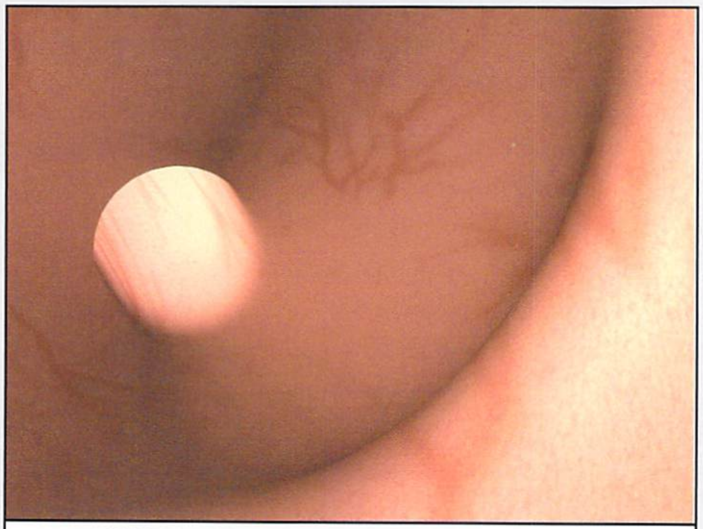
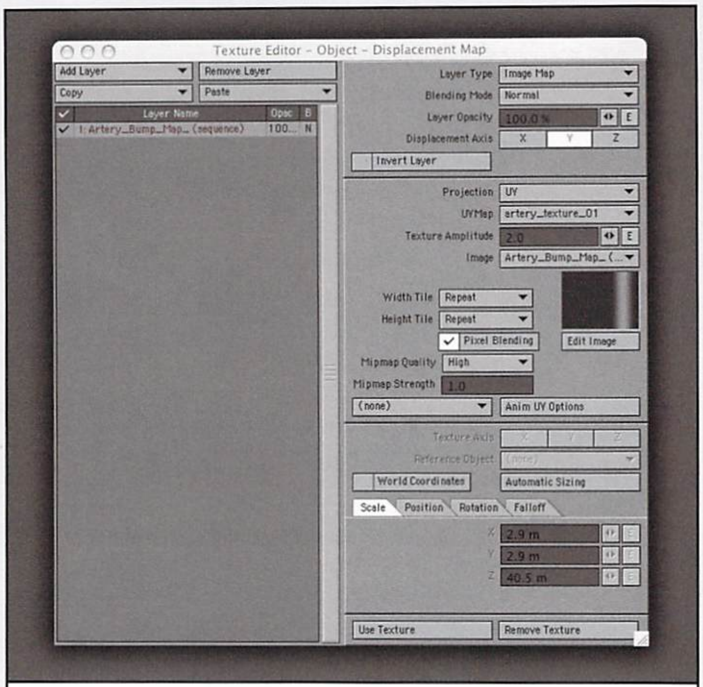


FIGURE 19– THE ARTERY WITH THE TEXTURE MAP APPLIED

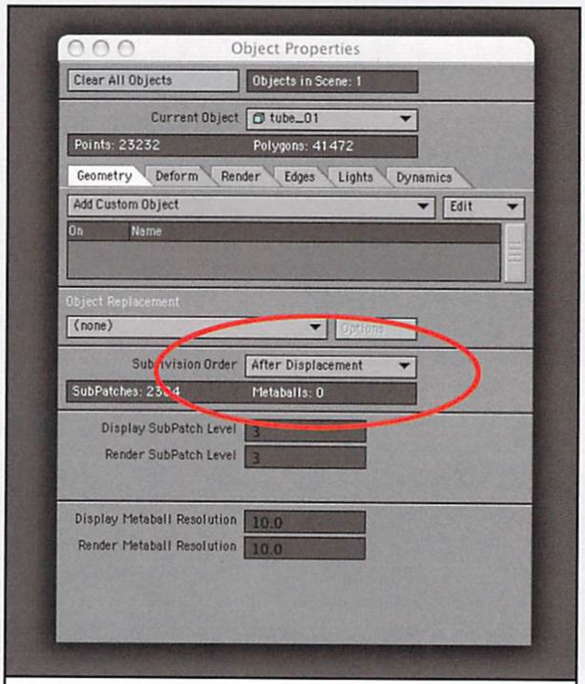
The LightWave Texture Editor has functions and mix modes that are very similar to Photoshop. Placing the textured image towards the bottom of the stacking order allows any other images or procedural textures higher in the order to affect it. Figure 19 shows a render of the artery with the texture applied, but no displacement or bump settings applied. (Note: When we apply the texture, we're using the UV map we created earlier.) Use the same UV map with the bump map to ensure that everything lines up.


Texture Editor - Object - Displacement Map
Add Layer
Remove Layer
Copy
Paste
Layer Name
Opac
B
Invert Layer
Edit Image
Anim UV Options
Texture Axis
Reference Object
World Coordinates
Automatic Sizing
Scale
Position
Rotation
Falloff
Use Texture
Remove Texture

I: Artery_Bump_Map_ (sequence) 100... N

Layer Type: Image Map
Blending Mode: Normal
Layer Opacity: 100.0 %
Displacement Axis: X Y Z
Projection: UV
UVMap: artery_texture_01
Texture Amplitude: 2.0
Image: Artery_Bump_Map_ (...
Width Tile: Repeat
Height Tile: Repeat
☑ Pixel Blending
Mipmap Quality: High
Mipmap Strength: 1.0
(none)
X: 2.9 m
Y: 2.9 m
Z: 40.5 m

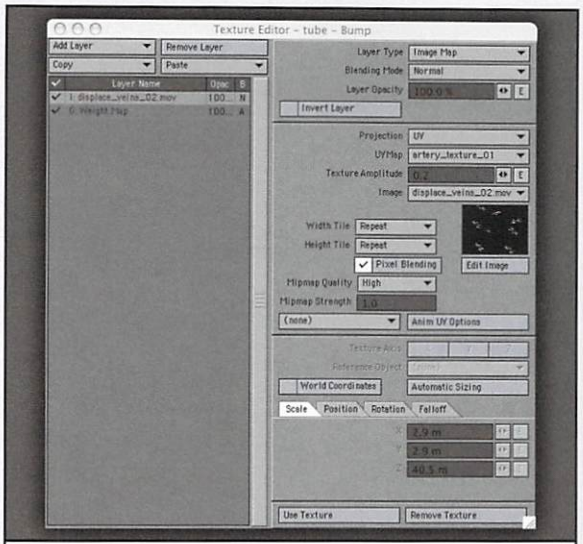
FIGURE 20– THE ARTERY DISPLACEMENT MAP IS APPLIED IN THE OBJECTS PROPERTIES PANEL. THE DISPLACEMENT MAP EDITOR IS NEARLY IDENTICAL (AND AS FLEXIBLE) AS ANY OF THE DIALOGUE BOXES INSIDE THE SURFACING WINDOW


Object Properties
Clear All Objects
Geometry
Deform
Render
Edges
Lights
Dynamics
Add Custom Object
Edit
On
Name
Object Replacement
Options

Objects in Scene: 1
Current Object: tube_01
Points: 23232
Polygons: 41472
(none)
Subdivision Order: After Displacement
SubPatches: 2304
Metaballs: 0
Display SubPatch Level: 3
Render SubPatch Level: 3
Display Metaball Resolution: 10.0
Render Metaball Resolution: 10.0

FIGURE 21– MAKE SURE TO SUBPATCH THE OBJECT AFTER DISPLACEMENT IN ORDER TO AVOID UNPREDICTABLE DISTORTIONS IN THE GEOMETRY

Next, apply the displacement map to deform the object's geometry. Displacement mapping is accessed inside the object's Properties panel under the Deform tab. Clicking the "T" button next to "displacement map" opens a texture dialogue box. Inside this box, we'll add the displacement sequence we rendered in After Effects, and use the UV texture we created to map it onto the tube (see figure 20). Back in the Properties panel, select the Geometry tab and set the subdivision order to "occur after displacement mapping" (see figure 21). If we don't sub-patch our tube object last, the object's geometry can distort in unpredictable ways, producing surfacing errors (to put it lightly).



1: displace_veins_02.mov 100... N
0: Weight Map 100... A

Layer Type: Image Map
Blending Mode: Normal
Layer Opacity: 100.0 %
Projection: UV
UVMap: artery_texture_01
Texture Amplitude: 0.2
Image: displace_veins_02.mov
Width Tile: Repeat
Height Tile: Repeat
☑ Pixel Blending
Mipmap Quality: High
Mipmap Strength: 1.0
(none)
X: 2.9 m
Y: 2.9 m
Z: 40.5 m

FIGURE 22– INSIDE THE SURFACE EDITOR'S BUMP CHANNEL WE'LL APPLY THE HI-CONTRAST MOVIE OF THE VEINS TO MAKE THE THEM APPEAR TO BE MOVING UNDER THE SKIN WHEN THE BLOOD PULSES THROUGH THEM

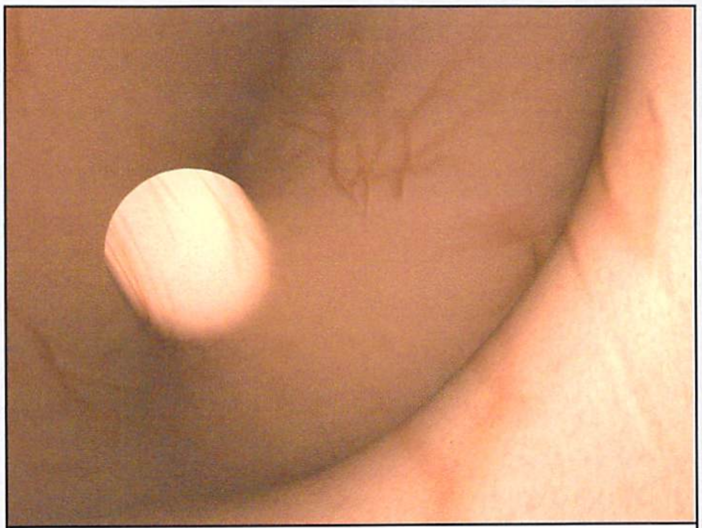


FIGURE 23– HERE'S THE IMAGE WITH THE TEXTURE, DISPLACEMENT AND BUMP MAPS APPLIED

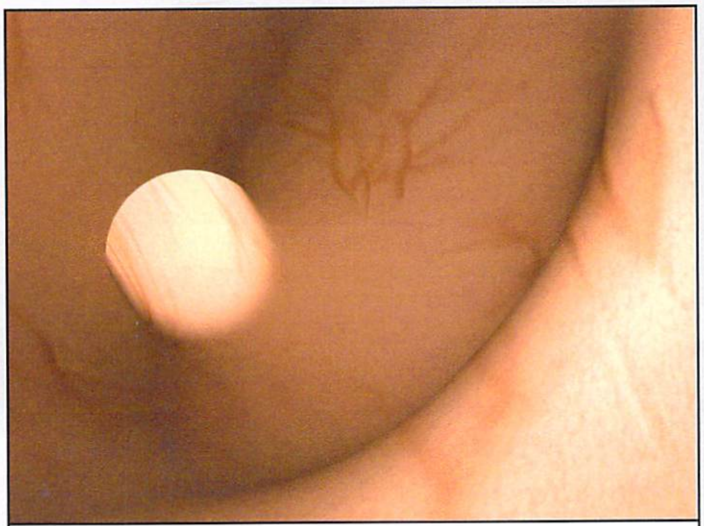


FIGURE 24– THE FINAL IMAGE WITH A BIT OF NOISE ADDED TO SOFTEN THE IMAGE

Next, we'll open the artery's bump channel inside the Surface Editor and apply the high-contrast artery bump sequence (see figure 22). Again, by using the same UV map, we're ensuring that everything lines up correctly. In figure 23, you'll see the artery with texture, displacement, and bump maps applied. The bump amplitude we need for the arteries is only about .2%. Finally, as shown in figure 24, apply some grain to soften the CG look of the rendered image. If you don't have any film grain plug-ins, you can mix up a passable grainy look in After Effects or Photoshop. Searching the Web for tutorials will turn up a lot of good finds and techniques. Ah, the beauty of tutorials. Remember, After Effects is pretty much Photoshop with keyframes, so don't write off Photoshop tutorials if you're an animator; some translate into After Effects or even the LightWave Texture Editor very well.

So remember, there are always different ways to achieve results in LightWave by employing your skills from other programs. If it saves you time and looks good, then it's justified. After Effects adds that extra punch and details that will bring your 3D creations to the next level. Get going and figure out a couple of uses for animated displacement and image maps. Off the top of my head, here are a couple ideas:

1) An intricate gel-like user interface that extrudes and recesses itself in a computer panel.
2) A number of bullets or punches deforming a metal door.
3) A quick solution to leaving some footprints.
4) Cracks exploding out from an impact and cracking up a tile floor.
5) A set of speakers that vibrate and distort to an audio track.
6) A company's logo or name in an interesting font appearing on a glass surface.
7) The vein on a gambler's temple starting to throb during a high stakes card game.

***NOTE:*** FEEL LIKE PLAYING AROUND WITH THE PROJECT? AARON'S PROVIDED THE PHOTOSHOP, LIGHTWAVE, AND AFTER EFFECTS FILES FOR DOWNLOAD AT **WWW.HDRI3D.COM/RESOURCES**

**AARON KENT** IS AN AFTER EFFECTS AND LIGHTWAVE ARTIST WORKING IN NYC. DURING THE DAY HE WORKS AT A POST HOUSE CALLED VIZUALSOLUTIONS (WWW.VIZUALSOLUTIONS.COM) IF HE EVER GETS ANY OF HIS PERSONAL 3D WORK DONE, YOU'LL FIND IT AT WWW.SHIFTLESSDREAMS.COM. HE LIVES IN BROOKLYN.

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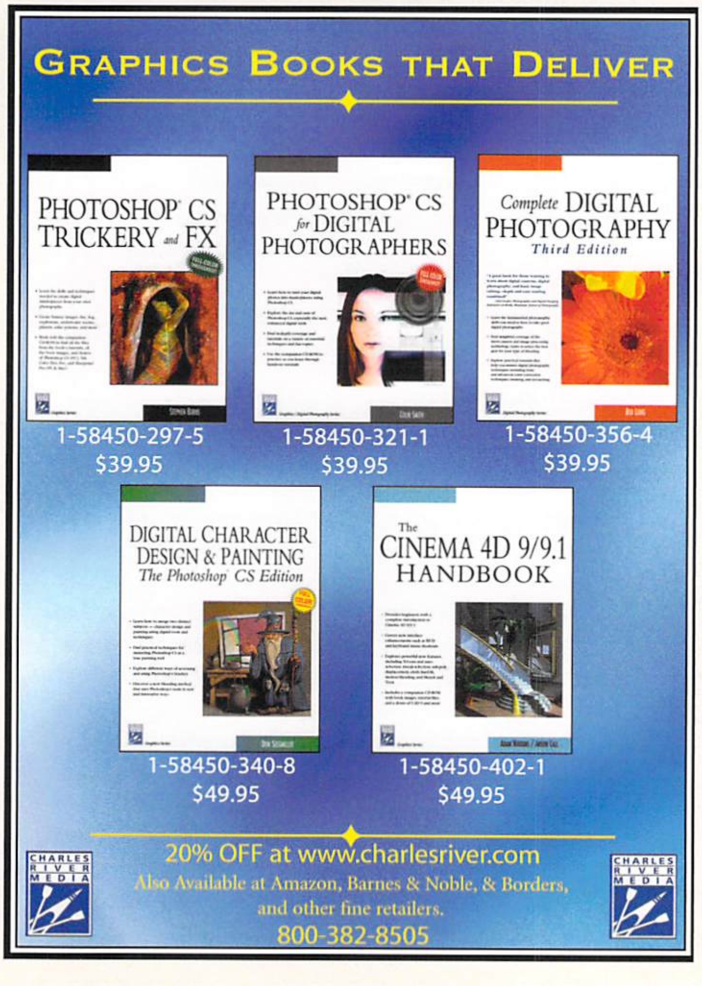
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In almost all design schools, the main method of study is critique. You present your work, and a teacher or a panel of judges comments on it to push your thinking forward. We'd like to bring that mentality to our Gallery, and give a chance for the submissions to receive advice and comments from professional eyes. First, my apologies beforehand for offending any of the artists. I come from a long line of looking, making, giving, and taking criticism. This stuff is difficult. It is difficult on an artistic level, a pragmatic and technical level. All of these submissions take a lot of courage and faith, and far be it from me to discourage anyone from making something for him or herself. So take the words that come below as a point from which to grow, and nothing mean. But candor and honesty save time and get results. Thank you for your submissions, and we look forward to seeing more of them to come from all who like showing their work. – ***Dariush***

TITLE: **SEEING IS IN THE MIND**

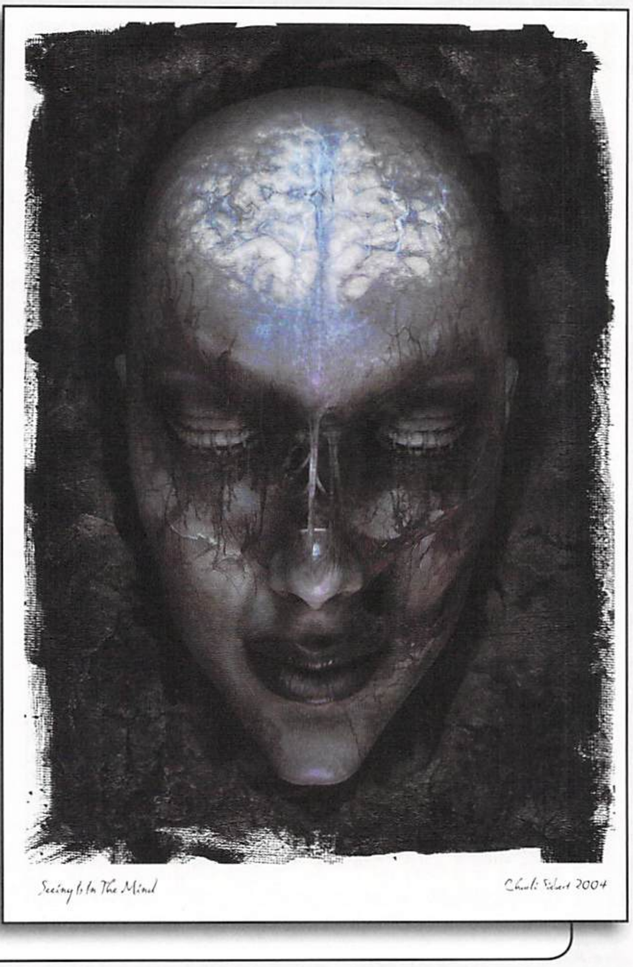
ARTIST: **CHARLI SIEBERT**
**HUNTINGTON BEACH, CA**

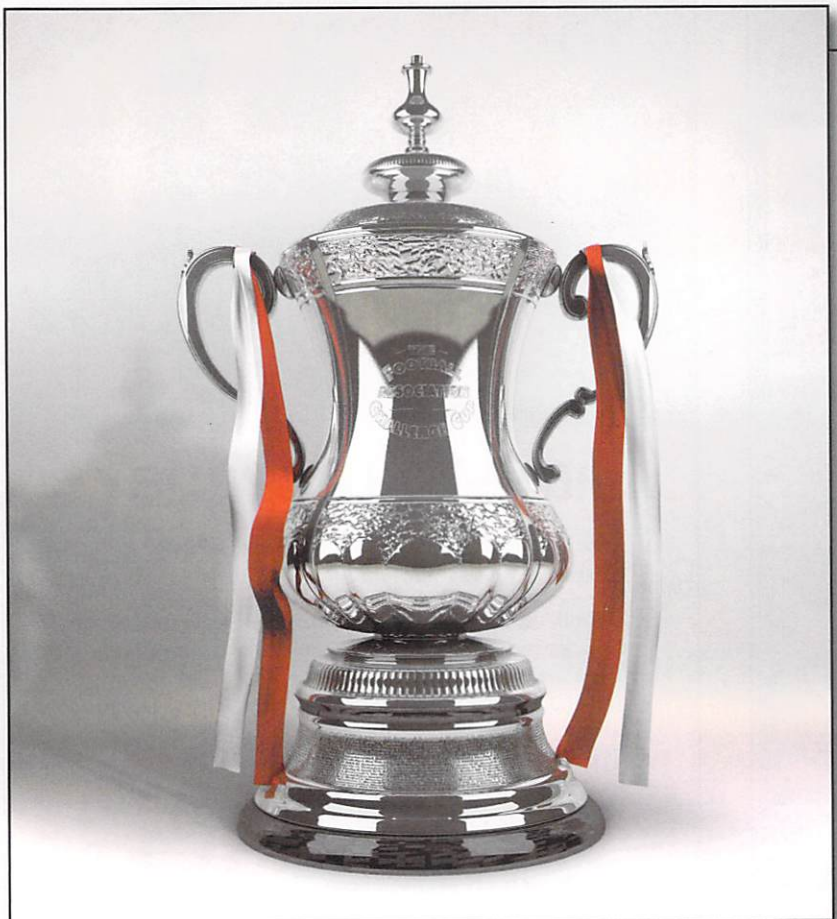
METHODS: **HEAD RENDERED IN POSER 4 AND DETAILS ADDED IN PHOTOSHOP 7**

TIME: RENDER: **ABOUT 2 MINUTES**
CREATION: **ABOUT 10 HOURS**

EDITOR'S NOTES:

This is a good example of using 3D as a start, a means to an end that is different than the medium. I'd love to see the different stages of this creation to see the elements you used. I like the style of this, though it tends to flatten the frame a bit. Having some more depth to the face by adding falloff to the sides of the forehead and cheeks would be cool. Also, adding some falloff distortion to the images on the face itself would give more of a feeling of depth to the face; for example, warping the cheek images to bow back toward the black edges to bring out the cheeks a bit. But that totally may not be what you're going for; it's a purely subjective comment. Nice.





TITLE: **ARSENAL'S FA CUP**

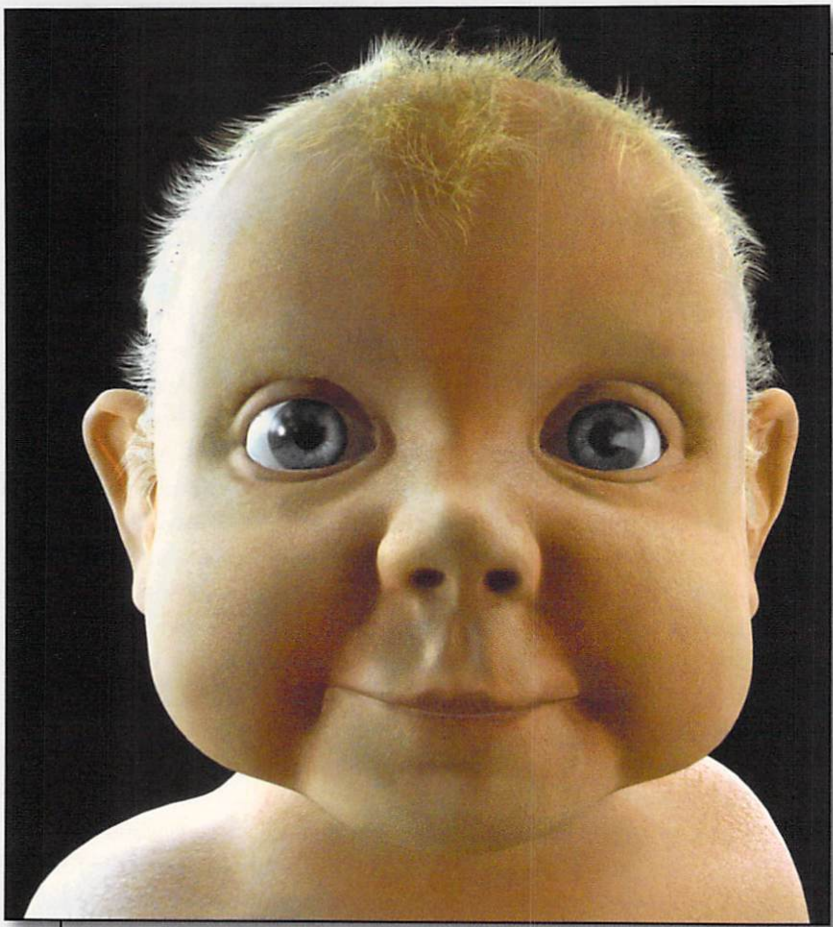
ARTIST: **ALEX DINNIN**
**SURBITON, SURREY, UK**

METHODS: **XSI.. WITH BUMPMAPS AND DISPLACEMENT... A TAD OF COMPING IN PHOTOSHOP !**

TIME: RENDER: **15 MINUTES**
CREATION: **3 DAYS**

EDITOR'S NOTES:

Metal is one of the harder surfaces (beyond skin) to light and render, and I think you've done a good job here. Artistically I wonder what the image is trying to say. That sounds pretentious as an observation; I hear every professor I've had in the back of my head, but cliché or not, it's true. I'd like to know if there is something that you are trying to say with the image beyond the nice lighting and rendering. And some of that could be said in the composition of the frame, how much you choose to reveal with light for example. On a pragmatic level, I wonder from where the magenta-tinted light is coming in the background to the right of the cup. I see a distinct shadow to the left falling on the floor/wall, so I sense a key light coming from the right of frame front, but I do not get that sense from the cup itself. The key light should be stronger on the right of the cup than on the left; it is too even, otherwise you should see a similar shadow also falling on the right, and both less sharp. Nicely done.



**TITLE:** **SURPRISING MOMENT**

**ARTIST:** **GUNTHER HEINRICH**
**STUTTGART, GERMANY**

**METHODS:** **SOFTIMAGE|XSI AND PHOTOSHOP FOR COLOR CORRECTION.**

**TIME:** **RENDER: ABOUT 3 HOURS**
**CREATION: 3 WEEKS**

**EDITOR'S NOTES:**

Awesome. It reminds me of my friend's paintings, Rebekah Waites, whom I met on a bus trying to score a date with on one particularly curious afternoon after class. Struck out, but she's cool as hell. Anyway, what I liked about her style is a subtle warping of how things actually look, and I see a lot of that in this frame. The hair looks great, and is lit very well with nice subtleties coming from the rim light. The baby texture is very nice with a strong sense of a painterly effect without being a painterly effect, so I am not judging it on a photorealistic level (which is a high bar indeed to clear). Eyes are cool, as is the slightly warped expression on the baby's face. I really think the harsher lighting you have here sells it, with the middle fairly dark and brighter highs on the right side of his face. The noise on the skin around the shoulders seems a bit much and I'd love to see some translucence in the thin cartilage of the ears. Overall, I would be very winded to find this as an oil painting. Maybe Rebekah should get off her baby fat ass and do a baby like this in oils.

**TITLE:** **DUSTMITE**

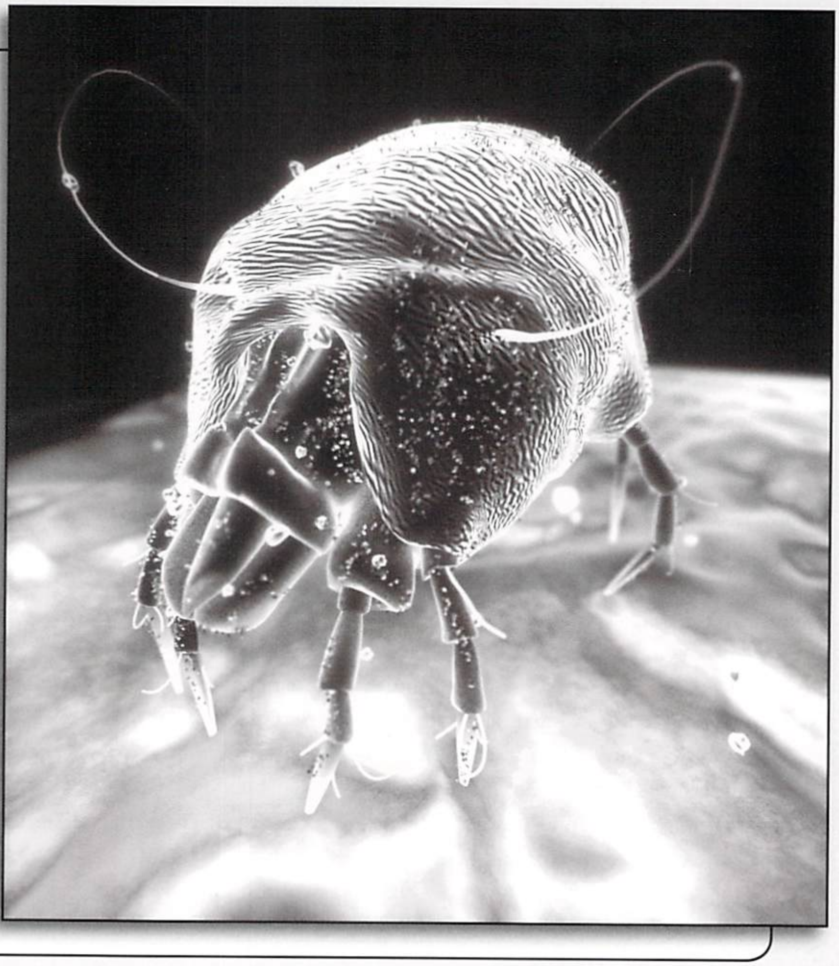
**ARTIST:** **ERIC KELLER**
**WASHINGTON DC**

**METHODS:** **CREATED IN MAYA USING NURBS GEOMETRY, PROCEDURAL TEXTURES, AND PAINT EFFECTS BRUSHES. BASED ON AN ELECTRON MICROSCOPE IMAGE OF A DUSTMITE.**

**TIME:** **RENDER: 2 MINUTES**
**CREATION: ABOUT A DAY. MOST OF THE TIME ON TWEAKING TEXTURES**

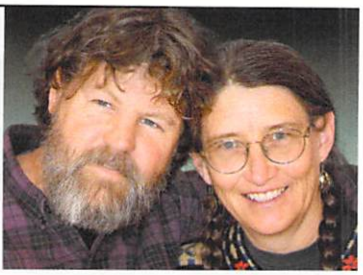
**EDITOR'S NOTES:**

Nice, I like the detail of focus, gives a nice macro-depth to it. I get the sense I'd like to see more of a contact between the legs of the bug and the skin of whatever it's standing on, the filthy thing. But I buy it, since I don't regularly look at microscope footage as a general rule. An interesting frame, and a well-executed scene, with a very fast render time, mostly based on textures, perhaps surface shaders and some incandescence mapping. The foreground of the skin he's standing on seems to be as soft as the horizon of it; it would be nice to see a bit more of the depth of focus work on the skin, where you see more in focus closer up than you do back there. Helps the depth of field.



# I WANT MY HDTV

BY BRAD CARVEY



**HDTV** has been coming for a long time. Some people would say it has been around for a long time, since, officially, it became a standard in the late 1990s. Actually, there are two standard formats (1080i and 720p) currently being broadcast, but only a small number of viewers are able to watch the higher resolution format (1080i).

About ten years ago, I dragged Andrea to NAB (National Association of Broadcasting convention). NAB happens once a year in Las Vegas and is the most important tradeshow for video in the United States. At the time, there were competing standards for High Definition TV, some of which were much better than what we have now. One of the booths that we passed displayed a large fish tank. There were lots of very cool fish swimming around in it. We approached the fish tank to get a better look. When we attempted to look at the fish from the side, we realized that it was a HD Monitor. I had never seen anything like it before or since.

Here in my lab, I do have an HDTV setup. Well, at least it's *kind* of an HD TV setup. To watch a movie in the 720p format (1280 x 720 pixels), first I need to take my 3.2 GHz Pentium computer out to the living room, and connect the computer's analog RGB outputs (using a hand built cable) to my GE projector.

Next, I have to calibrate the 10-year-old, (in projector years that's about 100 years old), 500-pound projector. I am getting pretty good at this and usually can be ready to watch a movie in about an hour. Then, I go to my DVD collection and try to decide which HD DVD feature film I want to watch. Fortunately, this does not take long, because there is only *one* HD feature film available on DVD (that I know of). My HD DVD collection is complete but limited. Looks like I will be watching *Terminator II: Judgement Day* (Extreme Edition) again. This DVD is encoded using Microsoft's WMV encoder and requires a fast computer to playback smoothly. The DVD includes the higher resolution HD 1080i format, but I would need a lot of new equipment before I could watch that. The movie looks and sounds great, but unfortunately it is already obsolete and may be the only feature film ever released on a WMV DVD.

Most of the "HD Ready" television sets that I see at places like Best Buy are touted as HD ready, but are not able to actually *display* a standard HD video signal. They are ready but not able. You can spend thousands of dollars on an "HD Ready" TV that can only display 1024 x 768 pixels. These monitors claim to be 16:9, but 1024 x 768 is 4:3, which has a ratio of 1.33333, in other words, the width is 1.33333 times wider than the height. HD 720p is 1280 x 720 and has a width that is 1.7777 times wider than the height. We could also consider square and rectangular pixels and make things even more complicated. The manufacturers choose the words "HD Ready" carefully. At Best Buy, the most expensive HD Ready TVs are able to display the 720p format (1280 x 720), but none of them could display the 1080i (1920 x 1080) format.

But take heart, things have started to change for the better. Comcast is starting to offer HD Ready DVRs (digital video recorders). At a reasonable price, you can watch and record HD broadcasts on NBC, CBS, ABC, and PBS. The Comcast DCT5100 High-Definition Cable Converter lists 1080i as one of its output resolutions. NBC (and I assume, the other networks) broadcast in both the 1080i and 720p formats. The good news is that the networks are ready for the "Full Featured HD" TVs. Apple is pushing to make it easier for everyone to make HD movies, and all new Apple computers support editing and playback of HD movies. QuickTime 7.0 will support HD formats, when it comes out in the next few months, and will support H.264, which is the standard that has been approved for the consumer HD DVDs. HD camcorders are still too expensive for most consumers, but they are getting better and cheaper.

As a digital artist, it is about time to start thinking of creating content for HD. QT 7.0 Pro for $29.95 will allow the digital artist to encode and distribute their videos to mainstream consumers, who will use QT 7.0 player to view the HD videos. I expect to see a big explosion of HD content over the next few years.

I will be happy when I can have it all, an HDTV that supports 1080i, a consumer HD DVD player, an HD Camcorder, cheap HD DVD rentals, and the Comcast HD DVR. Personally, I want my HD TV.

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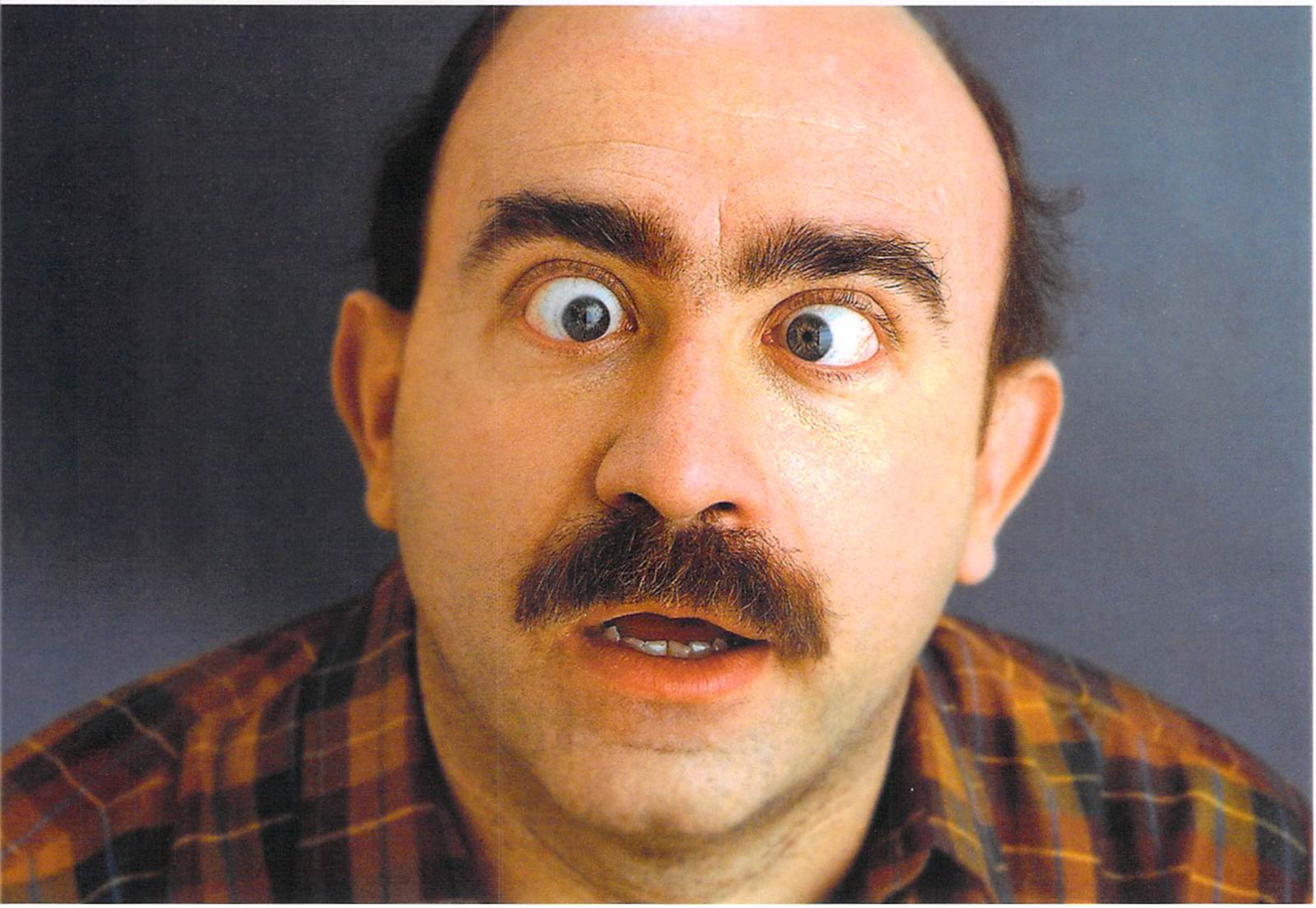

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